

TERTIARY FOSSIL PLANTS FROM THE ARGENTINE REPUBLIC

By EDWARD W. BERRY

Of Johns Hopkins University, Baltimore, Md.

INTRODUCTION

There are in the United States National Museum several small lots of rather indifferently preserved fossil plants collected by Chester W. Washburne in the Territories of Rio Negro and Santa Cruz during the explorations of the Hydrological Survey made for the Government of Argentina under the direction of Bailey Willis in 1911-1913. All are impressions of foliage, for the most part fragmentary, and preserved in clayey or sandy tuffs. The character of the material and its small amount render it impossible to deduce any far-reaching conclusions; nevertheless, considerable that is of interest has resulted from its study.

In striking contrast with the wealth of information regarding the Tertiary terrestrial faunas of Patagonia, very little is known about the contemporaneous terrestrial floras. In 1899 Dusén described¹ a small and rather poor collection of plants of Tertiary age from what he called the *Fagus* and *Araucaria* zones from several localities on both sides of the Strait of Magellan, and in 1925 I described² a rather well preserved collection from Chubut Territory which appeared to have come from the so-called Santa Cruz formation.

LOCALITIES

The present collections came from the following five localities—three in Rio Negro Territory and two in Santa Cruz Territory—and the only information I have regarding them is contained on the labels accompanying them. The Rio Negro localities are all in the vicinity of Lago Nahuel Huapi, and with the collectors numbers are:

176. Folded tuffs 4 km. west southwest of Bernal (4 leagues southeast of Barriloché);

¹ Dusén, P., Svenska Exped. Magellansländerna, vol. 1, No. 4, 1899.

² Berry, Edward W., Johns Hopkins University Studies in Geology, No. 6, 1925.

196. Tuff (thin bedded SS) on axis of anticline, $2\frac{1}{2}$ leagues above embouchure of canyon of Rio Nirihuao into basin of Lago Nahuel Huapi; and

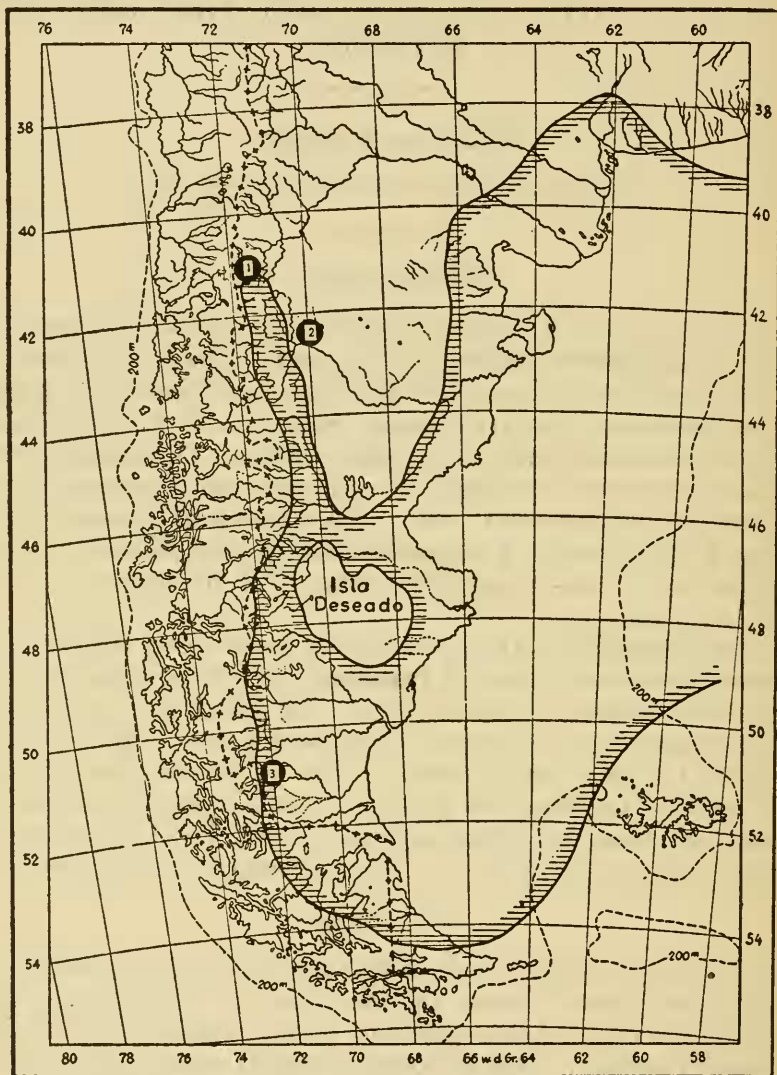


FIG. 1.—LOCALITIES IN LAGO NAHUEL HUAPI REGION, RIO NEGRO TERRITORY; 2. LOCALITY OF MIRHOJA, CHUBUT TERRITORY; 3. LOCALITIES IN RIO CHALIA REGION, SANTA CRUZ TERRITORY

198. Southeast side of Rio Nirihuao, $1\frac{1}{2}$ leagues above foot of canyon, 150 yards southwest of Casa Piedra (4 leagues south of Lago Nahuel Huapi).

The two Santa Cruz localities are:

112. (One league north of Estancia Chalia) (Bob. Lively's place in lot 77), Rio Chalia; and

116. (Bluff $\frac{1}{2}$ league south of Mata Amarilla, upper Rio Chalia.) The age of the last is given as Santa Cruzian?

FLORA

A total of 27 different forms are more or less satisfactorily identified and 19 of these appear to be new. They comprise 22 genera in 17 families and 14 orders, and represent 4 ferns, 1 cycad, 2 conifers, 1 monocotyledon, and 19 dicotyledons. None except fern genera have furnished more than a single species and no families except the Polypodiaceae and Monimiaceae are represented by more than a single species.

The largest number of forms identified from any single locality is but 9. There are 16 species recorded from the Rio Negro localities and 11 from the Rio Chalia localities. None are common to the two; even the genera are all different, and they appear to be different in age as well as in the environmental conditions which they indicate.

The three Rio Negro localities have but one species common to two of them, so that they may not be of exactly the same age, but the data are insufficient to affirm or deny this, and I am considering them collectively as affording certain contrasts with the two Rio Chalia localities.

These three localities in Rio Negro Territory are all in the vicinity of Lago Nahuel Huapi and apparently from what Roth called the Piso de Nahuel Huapi. They have yielded the following florule:

Alsophila antarctica.

Pteris nirihuaensis.

Filicites sp. 1.

Filicites sp. 2.

Zamia australis.

Araucaria nathorstii.

Scirpites sp.

Fagus (?) *subferruginea.*

Nothofagus simplicidens.

Leguminosites calliandraformis.

Leguminosites sp.

Anacardites (?) *patagonicus.*

Myrcia niteus.

Phyllites nirihuaensis.

Phyllites mollinediaformis.

Phyllites sp. (cf. *Schinopsis*).

This florule is too small for any accurate ecologic estimate; nevertheless the *Zamia* is the only form that is far removed from its present-day range, and *Zamia* occurs abundantly in the lower Miocene coal measures of the Arauco district in Chile, where, however, it is associated with much warmer types. A comparison with the flora described from Mirhoja, Chubut Territory, nearly 2° farther south, shows no common species between the two and none of the mesophytic warm types of the latter, so that the present florule must be considered to be a distinctly cooler temperate flora. Compared with

the existing flora of the Lago Nahuel Huapi district, it shows no certain indications of different temperature conditions but does seem to indicate considerable more humidity and an environment more like that found at the present time west of the Andes in Chile. If this conclusion is valid, it would mean less extremes of temperature throughout the year as compared with present conditions in Rio Negro Territory.

The florule from the two localities in the Rio Chalia district of western Santa Cruz Territory includes the following 11 species:

Adiantum patagonicum.

Fitzroya tertiaria.

Rollinia (?) *patagonica*.

Hydrangea (?) *incerta*.

Sterculia washburnii.

Peumus clarki.

Laurelia amarillana.

Laurophyllum chalianum.

Apocynophyllum chalianum.

Bignonites chalianus.

Phyllites sp. 6 (?).

Although occurring about 8° farther south, it comprises a much more northern and warmer climate assemblage than the previous florule, *Fitzroya* being the only species that seems distinctly at home in this latitude at the present time and then only in the wet environment of the Chilean side of the Andes. One species, *Peumus clarki*, and several genera are common to the flora described from Mirhoja, Chubut Territory, and point to the present flora as having lived in a humid warm temperate environment.

INDICATIONS OF AGE

From what has been said in the preceding paragraphs, both the genera represented and the environment which they indicate point to these florules being of different ages. So much seems perfectly clear. Whether either or both should be considered Oligocene or Miocene is not so clear. The whole general question of the age of the Patagonian sedimentaries has given rise to a remarkable diversity of opinion, the principal contributors having been Ameghino, Roth, Gaudry, Scott, Hatcher, Ortmann, von Ihering, Wilckens, Cossmann, Wiman, Windhausen, and Matthew. The statement by the last-named author³ is one of the most recent and the most useful summary.

In a recent paper Schiller⁴ mentions well-preserved dicotyledonous leaves near Barriloché overlain by tuffs partly silicified, from which he enumerates 25 species of marine mollusca representing the Patagonian stage. From this there is some reason for supposing that

³ Matthew, W. D., in *Climate and Evolution*. Annals N. Y. Acad. Sci., vol. 24, pp. 171-318, 1915.

⁴ Schiller, W., *El Cerro "Ottoshöhe" de Bariloche*. Bol. Acad. Nac. d. Ciencias Argentina, vol. 30, pp. 335-339, 1927.

the three plant localities in the Lago Nahuel Huapi region are older than the Patagonian marine beds. This coincides with my former and present conclusions based upon a study of all available evidence, although, as has been frequently pointed out, this evidence is far from complete.

In former contributions⁵ I have considered Dusén's *Fagus* zone to be upper Eocene or lower Oligocene, since it occurs below the marine Magellanian, and his *Araucaria* zone to be upper Oligocene, since it occurs above the Magellanian and below the Patagonian.⁶ The second might be lower Miocene, but since its flora is so unlike the lower Miocene floras of Chile I have thought it to be older.

Table of distribution

	Rio Negro Territory			Santa Cruz Territory		Mirihola, Chubut Territory	Arauco District, Chile	Straits of Magellan	Seymour Island, Antarctica
	Locality 176	Locality 196	Locality 198	Locality 112	Locality 116				
<i>Alsophila antarctica</i>		×							×
<i>Adiantum patagonicum</i>				×					
<i>Pteris nirihuaensis</i>	×		×						
<i>Filicites</i> species 1.....	×								
<i>Filicites</i> species 2.....	×								
<i>Zamia australis</i>			×						
<i>Araucaria nathorstii</i>	×							×	
<i>Fitzroya tertiaria</i>				×					
<i>Scirpites</i> species.....			×						×
<i>Fagus subferrunginea</i>	×							×	
<i>Nothofagus simplicidens</i>			×					×	
<i>Rollinia</i> (?) <i>patagonica</i>					×				
<i>Hydrangea</i> (?) <i>incerta</i>					×				
<i>Leguminosites calliandraformis</i>		×							
<i>Leguminosites</i> species.....			×						
<i>Anacardites</i> (?) <i>patagonicus</i>			×						
<i>Sterculia washburnii</i>					×				
<i>Peumus clarki</i>					×	×			
<i>Laurelia amarillana</i>					×				
<i>Laurophyllum chalianum</i>				×					
<i>Myrcia nitens</i>	×						×	×	?
<i>Apocynophyllum chalianum</i>				×					
<i>Bignonites chalianus</i>				×					
<i>Phyllites nirihuaensis</i>			×						
<i>Phyllites mollinediaformis</i>			×						
<i>Phyllites</i> species (cf. <i>Schinopsis</i>).....			×						
<i>Phyllites</i> species 6.....					?				×

If the *Araucaria* and *Fagus* zones of Dusén have any stratigraphic validity, then the florule from the Lago Nahuel Huapi region is to be correlated with these zones, since as the accompanying table of

⁵ In First Pan Pacific Congress Proc., pt. 3, pp. 845-865, 1921.

⁶ According to the sections given by Hatcher and Nordenskiöld.

distribution shows 4 of the 16 species are identical with forms described by Dusén from these zones in the Straits of Magellan region and two additional are identical with forms described by this author from the Seymour Island Tertiary, the present occurrence representing their most northern known range. This may be stated in another way by saying that in the time immediately preceding the Patagonian transgression a humid and fairly cool temperature flora extended between 41° and 54° south latitude. Since I regard the Patagonian transgression as corresponding approximately to the Burdigalian stage of the European Miocene, it would mean that the Lago Nahuel Huapi fossil flora should be correlated with the lowest Miocene or the Oligocene of the Northern Hemisphere. Although denominated cool temperate, it is clear from its great north and south range and its possible extension to Antarctica that the climate at that time differed from that of the present in its greater uniformity and relative greater mildness in the far south.

The florule found at two localities on the upper Rio Chalia is markedly distinct from the other, not only in representing entirely different genera but in lacking any species common to the *Araucaria* or *Fagus* zones. It has, moreover, a species common to the Santa Cruz (?) flora of Mirhoja in Chubut Territory. As already mentioned, the plants have their modern relatives far to the northward of their fossil occurrence, and the leaves are individually much larger than any in the Rio Negro florule. They thus represent an occurrence of warm temperate types in latitude 49° south. Hatcher describes lower Patagonian marine beds from the upper Rio Chalia, and, so far as chronologic terms are concerned, there is little choice between the terms Patagonian and Santa Cruz, since I believe the latter, although partly contemporaneous with the Patagonian, extends upward to a somewhat later time.

Although the evidence is far from conclusive, it points to this florule being considerably younger than the other, and to its early Miocene age. The location of both this and the earlier florule are shown on the accompanying sketch map, the base of which is Windhausen's map, showing the marine transgression of the Patagonian. I have also indicated the location of the Santa Cruz (?) plant locality at Mirhoja in Chubut Territory.

It will be noted that the localities in the vicinity of Lago Nahuel Huapi, which I regard as belonging to the pre-Patagonian *Araucaria* and *Fagus* zones, lie in an area which was transgressed by the marine waters of the long gulf depicted by Windhausen, that the localities on the upper Rio Chalia are interbedded in its marginal deposits, and that the Mirhoja locality, which I referred to the Santa Cruz, lies to the eastward of the Patagonian Gulf and was presumably a low-lying

country. If the map is correct the geography would favor warm currents from the Atlantic and the land barrier would temper Antarctic influences. We know that there was a corresponding submergence of the Chilean littoral at this time, and there is no evidence of high mountains on the site of the Andes, which is also negated by the floral evidence of equability and humidity.

DESCRIPTIONS OF SPECIES

Order POLYPODIALES

Family CYATHEACEAE

Genus ALSOPHILA R. Browne

ALSOPHILA ANTARCTICA Christ (?)

Alsophila antarctica CHRIST in DUSÉN, Schwed. Südpolar-Exp., vol. 3, Lief. 3, p. 14, pl. 3, fig. 11, 1908.

This species was described for Dusén's account of the Tertiary plants from Seymour Island, Antarctica, by Professor Christ of Basel, who considered it most like the existing *Alsophila féeana* and *A. corcovadensis* of southern Brazil. A single fragment in the present collection is identical with the illustration of the Seymour Island type except that it is slightly smaller, and as it is sterile it might as well be considered to represent the genus *Polypodium*.

Occurrence.—Two and one-half leagues above emboucheur of the canyon of Rio Nirihuao into the basin of Lago Nahuel Huapi, Territory of Rio Negro.

Plesiotype.—Cat. No. 37851, U.S.N.M.

Family POLYPODIACEAE

Genus ADIANTUM Linnaeus

ADIANTUM PATAGONICUM, new species

Plate 1, Figures 5-7

There are more or less complete specimens of four pinnules in the collection, the largest and most complete being the one shown in Figure 5; a second is only about half the size of the former. Pinnules stipitate, nearly orbicular in outline, divided nearly symmetrically by narrow pointed sinuses into four principal (two terminal and two lateral) lobes and the lateral lobes more or less bisected. The distal margins are undulate. Terminal sinus widest and deepest, extending three-fourths of the distance to the base of the lamina,

the adjacent lobes being inequilaterally cuneate. Lateral sinuses similar but only about half as deep. The small sinuses dividing the lateral lobes into two unequal lobules narrow, acutely pointed, and shallow. Stipe flat, with broad band of aggregated vascular bundles down the middle; length, 1.3 centimeters. Lamina ranging in length from 1.25 to 2 centimeters in length and from 1.75 to 3 centimeters in maximum width. Texture subcoriaceous. Venation dichotomous, diverging as a double dichotomy in the decurrent base of the lamina, forking successively as shown in Figure 6. The veins are relatively stout but have the appearance of being immersed in the substance of the lamina. None of the specimens are distinctly fertile, but in places the distal margin shows a decidedly thickened carbonized border, as shown in Figure 7, which may represent fructifications. Some probability is furnished this interpretation, since no such thickening is shown along the distal margin of the upper right-hand lateral lobe. In most of the specimens the distal margins are more or less frayed and do not permit any checking of these features, which, while not exactly as in living *Adiantums*, are suggestively similar.

The genus contains upwards of 100 widely distributed existing species in the warmer parts of the world and extending southward to Chile, Paraguay, and Argentina, in some cases (*A. concinnum* Humboldt, Bonpland, and Kunth) over nearly 40° of latitude, so that they can not be said to be especially influenced by temperature differences. In general, the existing species are less lobate and less equilateral than the fossil, but in the absence of more representative material showing pinnules from different parts of a frond the validity of these apparent differences can not be evaluated. About a score of Cretaceous and Tertiary species have been referred to *Adiantum*, including the quite dissimilar *Adiantites borgoniana* Engelhardt⁷ from the Miocene of Lota, Chile. Among somewhat similar existing species the following may be mentioned: *Adiantum chilense* Kaulfuss of Chile, *A. pensile* Kunze of Brazil, *A. tenerum* Swartz of Mexico and the Antilles to Peru, and *A. concinnum* Humboldt, Bonpland, and Kunth which ranges from Central America to Chile. Perhaps as similar a recent form as any is the old world *Adiantum capillus-veneris* of Linnaeus.

Occurrence.—About 3 miles north of Estancia Chalia, Rio Chalia, Territory of Santa Cruz.

Holotype and paratypes.—Cat. No. 37852, USNM.

⁷ Engelhardt, H., *Abh. Senck. Naturf. Gesell.*, vol. 16, Heft 4, p. 644, pl. 2, figs. 6-9, 1891.

Genus *PTERIS* Linnaeus*PTERIS NIRIHUAOENSIS*, new species

Plate 1, Figures 3. 4

Based upon small fragments of pinnae, habit of frond consequently unknown. Pinnae linear-lanceolate, divided nearly to the rachis into relatively long linear, ultimately pointed segments. The sinuses are usually nearly symmetrically rounded and narrower than the segments, but in some instances in maximum-sized fragments the proximal lower margin of the segment is decurrent for a considerable distance, subtending a space wider than the width of the segments. The rachis is stout, prominent, and somewhat flexuous. Margins entire, but faintly undulate. Texture subcoriaceous. Midveins of the segments diverge from the rachis alternately at wide angles and continue to the tips of the segments. They give off at acute angles numerous laterals, the distal of which are simple subtended by once forked laterals and these in turn by twice forked laterals. This typical venation is not constant, however, for in a great many instances there are cross connections resulting in a reticulate venation, as shown in the accompanying figure.

The largest fragment seen is that shown in Figure 3 and is of a sterile pinnule. All of the specimens are much broken and distorted, but what I have considered to represent a piece of a fertile pinna is shown in Figure 4. This is slightly smaller than the sterile, but agrees with it in form and venation. What I take to represent a marginal indusium with its contained sori is a thick crust of carbonaceous matter along the margins of the segments. I could not develop any spores or structural features in this thickened mass, and it may simply represent revolute margins. However, its appearance is significantly like fertile fragments of *Pteris*, and I have given this feature considerable weight in the identification of the fossils.

The vegetative habit, as incompletely determinable from the present fossils, is shared among a large number of fern genera, among which I might mention *Phegopteris*, *Goniopteris*, *Dryopteris*, *Cyathea*, and *Gleichenia* as genera likely to occur in the Patagonian Tertiary. All of these differ in having inframarginal sori and the venation is not reticulate in *Dryopteris* (restricted), *Cyathea* or *Gleichenia* (used in a supergeneric sense). *Phegopteris* sometimes shows a similar reticulate venation, but it is more regular, as it is also in those species of *Goniopteris* which are reticulate.

Many species of *Pteris* have the form of the fossil, and a similarly reticulate venation occurs in widely scattered forms in Asia and New

Zealand, as well as in Central and South America. This in combination with the supposed fertile specimens agree in pointing to *Pteris* as the genus to which the fossil should be referred. A large and rather questionable *Pteris* has been recorded by Engelhardt from the Arauco coal measures (Miocene) of Chile.⁸

Occurrence.—Folded tuffs 4 km. west southwest of Bernal, about 12 miles southeast of Barriloche, Lago Nahuel Huapi, and southeast side of Rio Nirihuao near Casa Piedra, about 12 miles south of Lago Nahuel Huapi, Territory of Rio Negro.

Cotypes.—Cat. Nos. 37853, 37854, U.S.N.M.

Genus **FILICITES** Schlotheim

FILICITES species 1

Plate 1, Figure 1

Represented by the single fragment figured, showing a linear pinnule with central midvein and numerous thin subparallel laterals diverging from the midvein at wide angles. The material is too incomplete and poorly preserved to admit of its identification. The margin appears simple, but it may have been finely toothed. The laterals appear simple, but they may have occasionally been dichotomous. Naturally, resemblances could be pointed out to numerous unrelated fern genera. The fossil is perhaps most like the pinnules of the existing and wide-ranging *Gleichenia* (*Dicranopteris*) of South America.

Occurrence.—Four km. west southwest of Bernal, 12 miles southeast of Barriloche, Lago Nahuel Huapi, Territory of Rio Negro.

Cat. No. 37855, U.S.N.M.

FILICITES species 2

Plate 1, Figure 2

A poorly preserved fragment of a fern pinna with short pinnulate lobes, rather coriaceous texture, and faint venation. The tips of the segments are frayed and may have been more elongate than they are depicted.

This fern is undeterminable. It resembles a fragment from the Tertiary of Seymour Island, Graham Land, which Dusén⁹ called *Pecopteris* species 1. It might well be a *Dryopteris*.

Occurrence.—Four km. west-southwest of Bernal, 12 miles southeast of Barriloche, Lago Nahuel Huapi, Territory of Rio Negro.

Cat. No. 37856, U.S.N.M.

⁸ Engelhardt, H., Abh. Senck. Naturf. Gesell., vol. 16, Heft 4, p. 643, pl. 2, figs. 1-4, 1891.

⁹ Dusén, P., Schwed. Südpolar-Exped., vol. 3, Lief. 3, p. 19, pl. 4, fig. 5, 1908.

Order CYCADALES

Family CYCADACEAE

Genus ZAMIA Linnaeus

ZAMIA AUSTRALIS, new species

Plate 2, Figure 1

Frond tiny, ovate lanceolate in outline, about 5.5 centimeters long and 1.4 centimeters in maximum width, consisting of about 32 pairs of subopposite to alternate pinnules. Pinnules oriented at angles of about 65° to the rachis, to the top surface of which they are united by the whole width of their bases. They are entire, strictly linear in outline, and conspicuously truncate at their tips. Their texture is coriaceous and their few veined longitudinally parallel venation is very faint, possibly because the specimens show only the upper surface of the frond. That it is the upper surface seen and that the pinnules are attached to the upper surface of the rachis is shown by the fact that the bases of the pinnules nearly meet and the outline of the broader rachis can be made out beneath their proximal edges.

This characteristic little form is one of the most interesting in the whole collection. It is based upon two nearly complete specimens and represents the southernmost known extent of the genus in either the past or the present.

The genus *Zamia*, whose species are not at all genetically related to numerous fossil forms that have been described as species of *Zamites*, contains about 35 existing species, ranging from peninsular Florida, Mexico, and the Antilles through northern South America and along the eastern and in that region wetter Andean slopes to eastern Bolivia and northwestern Argentina.

Zamia is the dominant existing cycad genus of the Western Hemisphere, and its range in the Tertiary was greater than at present, extending to latitude $36^\circ 30'$ north in the Eocene.¹⁰ A South American Pliocene species was recorded by Krasser¹¹ from Bahia, Brazil, but was not represented in the collections which I obtained from the same locality. A splendid species occurs in the Arauco coal fields (Miocene) of Chile.¹² This last is much larger and quite different from the present form, which is very similar to the small species of Florida with underground stem.

¹⁰ Berry, Edward W., *Torreyia*, vol. 16, pp. 177-179, figs. 1-3, 1916.

¹¹ Krasser, F., *Sitz. k. Akad. Wiss. Wien*, vol. 112, ab. 1, p. 853, 1903.

¹² Berry, Edward W., *Johns Hopkins Studies in Geology*, No. 4, p. 120, pl. 1, fig. 4; pl. 2, figs. 1-3, 1922.

The existing southern limit of *Zamia* is about 25° south latitude, the Chilean Miocene occurrence is about 38° south, and the present is in about latitude 41° 30' south, thus over 6½° south of the existing range.

Occurrence.—Southeast side of Rio Nirihuao, near Casa Piedra, about 12 miles south of Lago Nahuel Huapi, Territory of Rio Negro.

Holotype.—Cat. No. 37857, U.S.N.M.

Order ARAUCARIALES

Family ARAUCACEAE

Genus ARAUCARIA Jussieu

ARAUCARIA NATHORSTI Dusén

Plate 2. Figures 5, 6

Araucaria nathorsti DUSÉN, Svensk. Exped. till Magellansländerna, vol. 1, No. 4, p. 105, pl. 12, figs. 1–13, 1899.

This species was described by Dusén from the lignitic shales near Punta Arenas, where it is so abundant that this horizon was christened the Araucaria stage. Dusén distinguishes between the leaves of sterile and fertile twigs, the latter being usually larger, broader, and more ovate (triangular of Dusén), with a broader decurrent base.

The smaller leaf figured is identical with Dusén's, Figures 5 or 11, but the larger, which predominate in the present collection, are larger and more produced pointed than any he has figured and have more veins than the smaller leaf. The smaller have 12 to 13 veins and the larger about twice as many. While inclining to doubt the possibility of assigning the detached fossil leaves to sterile or fertile shoots, I see no reason to doubt that the present collection represents the same species as that described from the Straits of Magellan.

Dusén compared the fossil with the existing Chilean pine, *Araucaria imbricata* Pavon, and the similarity is as close as might be expected. If the two occurrences are identical in representing *Araucaria nathorsti*, this species ranges from about 53° south to nearly 41° south, or over nearly 12° of latitude, and this is in accord with the numerous occurrences of petrified wood of the Araucarioxylon type which has been reported by many explorers in various parts of this region. The fossil differs from the existing *Araucaria brasiliana* in its more coriaceous texture, in which respect it is much more similar to *Araucaria imbricata*, differing from both in the less contracted base.

Although both belong to the *Colymbea* section of the genus, it differs from *Araucaria araucoensis* Berry¹³ in its much larger and inferentially more crowded leaves, which also differ in outline and in the width at the basal flexure.

Araucaria imponens described by Dusén¹⁴ from the Tertiary of Seymour Island, Antarctica, has much the general form of the larger leaves from Rio Negro Territory with a wide base, but is more distinctly lanceolate and has fewer veins—not very constant or important features. Its describer considers the Antarctic species to be closer to *Araucaria brasiliana* than to *Araucaria imbricata*; but as it is represented by very meager material, there is little basis for an opinion.

Occurrence.—Four km. west southwest of Bernal, about 12 miles southeast of Barriloché, Territory of Rio Negro.

Plesiotypes.—Cat. No. 37858, U. S. N. M.

Order PINALES

Family CUPRESSINACEAE

Genus FITZROYA Hooker f.

FITZROYA TERTIARIA, new species

Plate 2, Figures 2-4

Leafy twigs, slender, branching; covered with ovate, pointed, appressed, imbricated leaves, with broadly decurrent bases. The phyllotaxy can not be determined, but as the leaf points usually rise to different levels the effect is of a spiral phyllotaxis, whatever the arrangement at their insertion may have been. (*F. patagonica* is said to have the leaves in alternate trimerous whorls.) These leaves are flat or convex with the contour of the twigs and not keeled; some are slightly divergent, and perhaps a majority have recurved tips, but the habit is much more appressed than in the single specimen of *Fitzroya patagonica* that has been available for comparison. In some fragments where the plant substance is preserved it is seen to be coriaceous and shows traces of a wide but not prominent midvein as in the recent species.

Although only sterile twigs have been seen and no microscopical preparations have been made there is little doubt but that these

¹³ Berry, Edward W., Johns Hopkins Studies in Geology, No. 4, p. 122, pl. 3, figs. 1-4, 1922.

¹⁴ Dusén, P., Wiss. Ergeb. Schwed. Südpolar-Exped. 1901-1903, vol. 3, Lief. 3, p. 11, pl. 1, figs. 16, 17, 1908.

twigs represent the genus *Fitzroya*. Their place of occurrence and associates point to this conclusion, as do the correspondence in size of leaves, in their broad decurrent bases and general form and midvein. They are commonly somewhat more pointed than the leaves of the small amount of recent material seen and are also more appressed. The species is said to show considerable variability in the degree of crowding or spreading of the leaves.

The genus is an interesting one, the modern distribution of which has suggested that it was a relict genus, but no fossil species have heretofore been described, to my knowledge. There is also some difference of opinion regarding its position among the Coniferales. It has usually been associated with the Actinostrobinæ—all of whose members have a unique disconnected range—but it is by some authors¹⁵ removed from association with *Actinostrobus*, *Callitris*, and *Widdringtonia* and referred to the Cupressinaceæ. *Fitzroya patagonica* is a mesophytic type of the Chilean temperate rain forest, reaching its northern limit at about latitude 40° near Valdivia and extending southward nearly to the end of South America, overlapping slightly the western frontier of Argentina and southern Patagonia, where the environment is suitable. It is a large tree and reaches its largest size in palustrine environments.

A second species confined to Tasmania was described by Hooker in the monotypic genus *Diselma*. It has usually been considered to belong to the same genus as the Chilean tree, but recently it has been proposed to revive the genus *Diselma* for its reception. The question is one involving a great deal of personal equation, and whichever view finally prevails, there can be no doubt of the similarity and probable relationship between the two.

Occurrence.—About 3 miles north of Estancia Chalia, Rio Chalia, Territory of Santa Cruz.

Holotype.—Cat. No. 37859 U.S.N.M.

Class MONOCOTYLEDONAE

MONOCOTYLEDONAE INCERTAE SEDIS

SCIRPITIS species Dusén (?)

Plate 3, Figure 15

Scirpitis species DUSÉN, Schwed. Südpolar-Exped., vol. 3, Lief. 3, p. 16, pl. 2, fig. 6, 1908.

The coarseness of the parallel veins and the lack of a midvein stamp these remains as stem fragments. They vary considerably in size, the fragment figured being the largest seen. As far as one may

¹⁵ Seward, A. C., Fossil Plants, vol. 4, p. 124, 1919.

judge from figures, this is identical with what Dusén considered to represent a *Scirpus*-like sedge from the Tertiary of Seymour Island, Antarctica.

Obviously, little reliance can be placed upon this similarity, since both occurrences represent a type which might have been present in this region at any time from the Upper Cretaceous to the present and which could scarcely be expected to show differential characters.

Occurrence.—Southeast side of Rio Nirihuao near Casa Piedra, 12 miles south of Lago Nahuel Huapi, Territory of Rio Negro.

Cat. No. 37860 U.S.N.M.

Class DICOTYLEDONAE

Order FAGALES

Family FAGACEAE

Genus FAGUS Linnaeus (?)

FAGUS SUBFERRUGINEA Dusén

Fagus subferruginea DUSÉN, Svenske Exped. Magellansländerna, vol. 1, No. 4, p. 94, pl. 8, figs. 1–8, 1899.

This species was described by Dusén from near Punta Arenas and Barancas de Carmen Sylva in the Magellan Strait region. It is represented by a number of specimens in the present collection. I can see no valid reason for referring it to *Fagus* instead of *Nothofagus*. It is larger than the majority of leaves of *Nothofagus* and does resemble the leaves of the European beech; but occurring as it does in a profuse occurrence of *Nothofagus*, it is most unlikely to represent the northern genus.

Occurrence.—Four kilometers west southwest of Bernal, 12 miles southeast of Barriloche, Lago Nahuel Huapi, Territory of Rio Negro.

Cat. No. 37861, U.S.N.M.

Genus NOTHOFAGUS Blume

NOTHOFAGUS SIMPLICIDENS Dusén

Plate 2, Figures 7–9

Nothofagus simplicidens DUSÉN, Svenske Exped. till Magellansländerna, vol. 1, No. 4, p. 100, pl. 9, figs. 20–25, 1899.

This species was named—it can hardly be said to have been described—by Dusén in 1899. His material was abundant and came from the following localities in the vicinity of the Strait of Magellan: Barancas de Carmen Sylva, Rio Beta, Rio Condor, Bagnales, and near Punta Arenas.

Leaves, small, subcoriaceous, ovate in general outline, with an acute apex and a slightly inequilateral cuneate base. Margin with somewhat variable but invariably simple and relatively large teeth, one to each secondary. These teeth are prevailingly dentate, from which they grade into serrate, and some specimens approach what might be called crenate-serrate. Length ranging from 1.75 to 3.5 centimeters. Maximum width ranging from 0.75 to 1.5 centimeters. Petiole stout, usually missing, but preserved in one specimen to a length of 3.5 millimeters. Secondaries 10 to 12 pairs, opposite to alternate, thin, straight, subparallel or slightly divergent, craspedodrome, usually ascending at angles of about 45°, but subtending somewhat greater angles in the smaller and relatively wider forms. Tertiaries percurrent. Aerolation obsolete.

The genus *Nothofagus* comprises about 17 existing austral species, confined to southern Chile, Patagonia, and Tierra del Fuego in the Western Hemisphere and to southern Australia, Tasmania, and New Zealand in the Eastern Hemisphere. According to Skottsberg (1915), the recent species are distributed as follows: 6 in New Zealand, 1 in Tasmania, 1 in Tasmania and Victoria, 1 in New South Wales, and 8 in South America. The genus is divided into evergreen and deciduous sections. The deciduous species comprise 1 in Tasmania and 5 in South America. The evergreen section contains 3 in South America, all 6 of the New Zealand species, 1 in Tasmania and Victoria, and 1 in New South Wales. They are obviously related to *Fagus* of the Northern Hemisphere and for a long time were referred to that genus. *Fagus* has been recorded as a fossil associated with *Nothofagus* in South America, Australia, and New Zealand, but it may be questioned if the two can be separated on the basis of leaf form alone. Several forms resembling *Nothofagus* have been found in the Tertiary of Europe, but are equally unreliable. Recently Bandulska¹⁶ has described a *Nothofagus* from the Eocene of southern England, basing her determination upon the cuticular-structure which she claims to be able to differentiate from that of *Fagus*.

A large number of fossil species have been described from the Tertiary of the regions where the living species occur; at least two occur on Seymour Island, Antarctica.¹⁷ In considering the 13 species and varieties which Dusén has described from the Tertiary of Patagonia and Tierra del Fuego, one is impressed with the thought that perhaps the majority of these are the slightly varying leaves of a much fewer number of botanical species.

¹⁶ Bandulska, H., Journ. Linn. Soc. Bot., vol. 46, p. 433, pl. 39, fig. 20, 1924.

¹⁷ Dusén, P., Wiss. Ergeb. Schwed. Südpolar-Exped. 1901-1903, vol. 3, Lief. 3, p. 10, pl. 1, figs. 10, 12, 19; pl. 3, figs. 7-9, 1908.

The present species is not uncommon in the collection studied. In the existing flora *Nothofagus* extends northward on the wetter Chilean side of the Andes to about latitude 33°.

Occurrence.—Southeast side of Rio Nirihuao near Casa Piedra, about 12 miles south of Lago Nahuel Huapi, Territory of Rio Negro.

Plesiotypes.—Cat. No. 37862, U.S.N.M.

Order RANALES

Family ANONACEAE

Genus ROLLINIA St. Hiliare (?)

ROLLINIA (?) PATAGONICA, new species

Plate 2, Figure 11

Leaves of small size, ovate-elliptical in outline, widest medianly, with a narrowly rounded apex and a cuneate base. Margins entire. Texture subcoriaceous. Venation obsolete, due to carbonization of the lamina during fossilization. Length about 4.5 centimeters. Maximum width about 2.25 centimeters. Petiole short and stout, between 5 and 6 millimeters in length. Midvein straight, relatively stout and prominent. Secondary and tertiary venation not visible.

It is rather hazardous to attempt an identification of this leaf as representing the genus *Rollinia*. It agrees rather well with the existing *Rollinia parvifolia* of northeastern Argentina. The genus has about a score of existing species of shrubs and trees in the warmer parts of South America. A single fossil species not very different from the present form has been described from the Pliocene of eastern Brazil.¹⁸

Occurrence.—Bluff about 11½ miles south of Mata Amarilla, Upper Rio Chalia, Territory of Santa Cruz.

Holotype.—Cat. No. 37863, U.S.N.M.

Order ROSALES

Family SAXIFRAGACEAE

Genus HYDRANGEA Linnaeus (?)

HYDRANGEA (?) INCERTA, new species

Plate 5, Figure 2

Leaf oval in general outline, with a rounded apex and a truncate or broadly cuneate base, widest below the middle. Margins somewhat

¹⁸ Hollick and Berry, Johns Hopkins Studies in Geology, No. 5, p. 52, pl. 2, fig. 4, 1924.

irregularly sublobate. Texture coriaceous. Length about 5 centimeters. Maximum width about 3.5 centimeters. Midvein stout. Secondaries 4 or 5 irregularly spaced pairs, diverging from the midvein at varying angles, camptodrome.

The identity of this incomplete leaf is exceedingly problematical, and it may possibly represent some member of the Bignoniaceae. Both alternatives are represented in the existing flora of northern Argentina. *Hydrangea* is an ancient genus, cosmopolitan in existing floras and with several well-defined Tertiary species in the Northern Hemisphere, represented in Patagonia by *Hydrangeiphyllum affine* Dusén.¹⁹

Occurrence.—One and one-half miles south of Mata Amarilla, upper Rio Chalia, Territory of Santa Cruz.

Holotype.—Cat. No. 37864, U.S.N.M.

LEGUMINOSAE INCERTAE SEDIS

Genus LEGUMINOSITES Bowerbank

LEGUMINOSITES CALLIANDRAFORMIS, new species

Plate 3, Figures 13, 14

This species is based upon the single specimen figured, obviously representing a leaflet of some member of the alliance Leguminosae.

Leaflet small, very inequilaterally obovate. Apex broadly rounded, but slightly unsymmetrical. Base sessile, markedly inequilaterally cuneate. Margin entire. Texture subcoriaceous. Length about 11 millimeters. Maximum width about 5 millimeters. Midvein stout, much curved. Secondaries thin, ascending, curved, camptodrome; three from the extreme base, a slender one inside the midvein, and two coarser ones outside the midvein.

This leaflet is much like those of the genus *Calliandra* Benthham, which contains over 100 existing species, the majority in the warmer parts of South America. Two fossil species have been described from the Pliocene of Potosí, Bolivia. Since similarly veined leaflets occur in *Cassia*, *Caesalpinia*, and other genera of this alliance, and since the present material is so limited, it is referred to the form genus Leguminosites.

Occurrence.—Canyon of Rio Nirihuao, 2½ leagues above its embouchure in the basin of Lago Nahuel Huapi, Territory of Rio Negro.

Holotype.—Cat. No. 37865, U.S.N.M.

¹⁹ Dusén, P., Svenska Exped. till Magellanslånd, vol. 1, No. 4, p. 102, pl. 10, fig. 5, 1899.

LEGUMINOSITES species

Plate 3, Figure 17

Leaflet small, inequilaterally subelliptical, with about equally rounded apex and base. Margins entire. Length about 9.5 millimeters. Maximum width, above the middle, about 3.5 millimeters. Petiolule stout, curved, about 1 millimeter in length. Midvein not prominent. Balance of venation obscure. This obviously represents some member of the Leguminous alliance, but it affords no reliable generic features, and is therefore referred to the form genus Leguminosites.

Occurrence.—Southeast side of Rio Nirihuao, 150 yards southwest of Casa Piedra, about 12 miles south of Lago Nahuel Huapi, Territory of Rio Negro.

Cat. No. 37866, U.S.N.M.

Order SAPINDALES

Family ANACARDIACEAE

Genus ANACARDITES Saporta (?)

ANACARDITES (?) PATAGONICUS, new species

Plate 5, Figure 1

This is one of those leaves that is not especially characteristic. Its sessile base and slightly falcate outline suggest that it may represent a leaflet of a pinnate leaf. I identify it with considerable hesitation as a leaflet of some member of the Anacardiaceae which contains several South American genera similar to the fossil.

Medium-sized, ovate-falcate in outline, widest medianly, with an acute tip and a slightly inequilateral more narrowed, sessile base. Margins entire. Texture subcoriaceous. Length about 5.5 centimeters. Maximum width about 1.75 centimeters. Midvein stout, prominent and curved. Secondaries thin, numerous, subparallel, camptodrome.

The generic name used was proposed by Saporta for leaflets of this family whose generic assignation was uncertain. A score of species have been described from the Tertiary of North America and Europe. Fossil species in South America have been found in Trinidad and Brazil.

Occurrence.—Southeast side of Rio Nirihuao, 150 yards southwest of Casa Piedra, about 12 miles south of Lago Nahuel Huapi, Territory of Rio Negro.

Holotype.—Cat. No. 37867, U.S.N.M.

Order MALVALES

Family STERCULIACEAE

Genus STERCULIA Linnaeus

STERCULIA WASHBURNII, new species

Plate 4, Figures 1-7

Since these leaves are variable and abundant at a single outcrop, I have considered that they represent a single species of *Sterculia*, a genus whose leaves are notoriously variable as to form and lobation. It may be described as follows:

Leaves variable in size and form, palmately three to five lobed. Lobes ovate with rounded tips or conical with acute tips. Sinuses openly rounded, shallow or extending about halfway to the base. Base ranging from decurrent to cuneate to truncate, depending on the number and attitude of the lobes, which may be directed obliquely upward or laterally. Petiole long and exceedingly stout, in one specimen preserved for a length of 3 centimeters. Margins entire. Texture coriaceous. Length ranging from 4 to 8 centimeters. Maximum width ranging from 2.5 to 8 or more centimeters. Primaries three, stout, diverging from the base, or subbasal in some of the forms with a decurrent base, diverging at acute angles. In the five-lobed forms the lateral primaries give off a short distance above their base a stout lateral which runs to the tip of the lower lateral lobe. Secondaries thin, camptodrome. Tertiaries thin, simple and percurrent, or flexed medianly, or sometimes forked medianly.

Named for the collector, Chester W. Washburne. This species has the general features of leaves of this genus, which first appear in considerable abundance in mid-Cretaceous floras of various parts of the world. The genus is common in the warmer parts of South America, at the present time ranging southward to the Argentine Mesopotamia (about latitude 30°). A second fossil Argentine species, not unlike but perfectly distinct from *Sterculia washburnii*, has been described from the supposed Santa Cruz beds of Chubut Territory.²⁰

Occurrence.—Bluff about 1½ miles south of Mata Amarilla, upper Rio Chalia, Territory of Santa Cruz.

Cotypes.—Cat. No. 37868, U.S.N.M.

²⁰ Berry, Edward W., Johns Hopkins Studies in Geology, No. 5, p. 220, pl. 9, figs. 5, 6, 1925.

Order LAURALES

Family MONIMIACEAE

Genus PEUMUS Persoon

PEUMUS CLARKI Berry

Plate 2, Figure 10

Peumus clarki BERRY, Johns Hopkins Studies in Geology, No. 6, p. 204, pl. 5, fig. 2, 1925.

This species was described from the supposed Santa Cruz beds of Mirhoja, Chubut Territory. The specimen from Santa Cruz territory is similar to the type in every respect except that it is slightly narrower, in consequence of which the sessile base is more acute.

The genus is monotypic in the existing flora of Chile, ranging, as an evergreen tree, from about latitude 30° to latitude 42°. The present fossil occurrence carries its range much farther south and extending it over nearly 7° of latitude in Argentina. In this connection it is possible that the leaf from the Tertiary of Seymour Island, Antarctica, described by Dusén²¹ as *Phyllites* species (2), may represent a second fossil species of *Peumus*.

Occurrence.—Bluff about 1½ miles south of Mata Amarilla, upper Rio Chalia, Territory of Santa Cruz.

Holotype.—Cat. No. 37869, U.S.N.M.

Genus LAURELIA Jussieu

LAURELIA AMARILLANA, new species

Plate 5, Figure 3

Leaf broadly lanceolate in outline, widest medianly and about equally pointed at the apex and the base. Base narrowly cuneate and decurrent. Margin entire for its basal third, above which it has somewhat irregularly and widely spaced undulate-crenate teeth. Texture coriaceous. Length about 6 centimeters. Maximum width about 2.5 centimeters. Petiole stout, 7 to 8 millimeters in length. Midvein stout, prominent on the under side of the leaf. Secondaries about 5 alternate pairs, diverging from the midvein at acute angles, thin, long ascending, inclined to be somewhat flexuous, camptodrome, but sending branches into the marginal teeth. Areolation obsolete, a few tertiaries seen, as shown in the illustration.

This greatly resembles the existing Chilean *Laurelia aromatica* Sprengel in all of its features. The genus contains three species in

²¹ Dusén, P., Wiss. Ergeb. Schwed. Südpolar-Exped., vol. 3, Lief. 3, p. 16, pl. 1, fig. 15, 1908.

the existing flora, one in New Zealand and the other two in Chile in the region between 36° and 42° south latitude. If botanical systematists are correct in their opinion that these belong to the same genus, then we are bound to presuppose that it had a geological history unless we are prepared to subscribe to the once fashionable but now absurd notion that a genus can originate more than once and in different areas. Excluding the highly problematical fossil forms from the Northern Hemisphere which have been referred to *Laurelia*, a fossil species has been described by Dusén²² from the Tertiary of Seymour Island, Antarctica.

This is a somewhat fragmentary specimen of a larger size, with less ascending secondaries and more pointed teeth than *Laurelia amarillana*, and also less similar to the existing *Laurelia aromatica*.

Occurrence.—Bluff one-half league south of Mata Amarilla, upper Rio Chalia, Territory of Santa Cruz.

Holotype.—Cat. No. 37870, U.S.N.M.

Family LAURACEAE

Genus LAUROPHYLLUM Goeppert

LAUROPHYLLUM CHALIANUM, new species

Plate 5, Figure 4

Leaves elongate-lanceolate, widest below the middle, with an extended gradually narrowed tip and a more abruptly acute base. Margins entire. Texture subcoriaceous. Length about 9 to 10 centimeters. Maximum width about 1.5 centimeters. Midvein stout, somewhat flexuous, prominent on the under side of the leaf. Secondaries thin, numerous, diverging from the midvein at acute angles, long ascending, eventually camptodrome. Tertiaries obsolete.

This species is represented by several incomplete specimens and is evidently Lauraceous. As it is impossible to determine its generic position with certainty, it is referred to the form genus *Laurophyllum*. It may represent the genus *Nectandra*, although similar leaves occur in several existing Lauraceous genera of the warmer parts of South America.

A typical species of *Nectandra* is present in the supposed Santa Cruz beds of Chubut Territory,²³ so that this genus is known to have ranged farther south during the Tertiary than it does at the present time.

Occurrence.—Three miles north of Estancia Chalia, Rio Chalia, Territory of Santa Cruz.

Holotype.—Cat. No. 37871, U.S.N.M.

²² Dusén, P., Schwed. Südpolar-Exped., vol. 3, Lief. 3, p. 4, pl. 1, fig. 5, 1908.

²³ Berry, Edward W., Johns Hopkins University Studies in Geology, No. 5, p. 224, pl. 8, fig. 1, 1925.

Order MYRTALES

Family MYRTACEAE

Genus MYRCIA De Candolle

MYRCIA NITENS Engelhardt

Plate 3, Figures 1-9

Myrcia (Cryptomyrcia) nitens ENGELHARDT, Abh. Senck. Naturf. Gesell., vol. 16, Heft 4, p. 679, pl. 10, fig. 7, 1891.

Myrtiphyllum bagualense DUSÉN, Svenska Exped. till Magellanslând., vol. 1, No. 4, p. 103, pl. 11, figs. 7-9, 1899.

This species was described by Engelhardt from the lower Miocene of Coronel, Chile. It is exceedingly abundant in all sizes in the present collection, and the larger leaves (such as those shown in figs. 7-9) are identical in every respect with Engelhardt's Chilean type. With these, and grading to much smaller but otherwise similar leaves, are a series of forms identical with those from southern Patagonia which Dusén described as *Myrtiphyllum bagualense*. Every gradation of size is represented in the present collection, and there can be no doubt but that a single botanical species is represented. It might possibly be argued that Dusén's, which come from over 11° farther south, were normally smaller, because of the possibly more severe climatic conditions. Among the leaves recorded by Dusén²⁴ from the Tertiary of Seymour Island, Antarctica, there is an apical fragment (*Phyllites* species 16) which very probably represents this same species.

Occurrence.—Four km. west southwest of Bernal, 12 miles south-east of Barriloche, Lago Nahuel Huapi, Territory of Rio Negro.

Plesiotypes.—Cat. No. 37872, U.S.N.M.

Order GENTIANALES

Family APOCYNACEAE

Genus APOCYNOPHYLLUM Unger

APOCYNOPHYLLUM CHALIANUM, new species

Plate 5, Figure 5

Leaf oblong, acutely pointed at the apex and base. Margins entire. Texture coriaceous. Length about 11 centimeters. Maximum width about 3.25 centimeters. Petiole stout, about 2.25 centimeters in length. Midvein stout, prominent. Secondaries thin, numerous, diverging from the midvein at wide angles, subparallel, ending in an acrodrome marginal vein parallel with and close to the leaf margins.

²⁴ Dusén, P., Schwed. Südpolar-Exped., vol. 3, Lief. 3, p. 18, pl. 2, fig. 10, 1903.

This form somewhat resembles *Myrcia costatoides* Engelhardt²⁵ of the lower Miocene of Chile, but is much larger and stouter with a much longer petiole. It does not conform to the features of any *Myrcias* with which I am familiar. There are, of course, leaves of this general type in various unrelated existing genera. Some figs have similar leaves, e. g., the existing *Ficus pulchella* Schott, but the venation is not quite the same and the inframarginal vein is usually farther within the margins and arched from secondary to secondary.

Somewhat similar leaves occur in various Myrtaceae and Guttiferae, but the type is especially characteristic of a considerable number of genera of the Apocynaceae and can be exactly matched among existing species of *Plumiera* and *Allamanda*. For these reasons I feel justified in referring it to the form genus *Apocynophyllum*.

Nothing of this kind was found in the supposed Miocene flora from Mirhoja, Territory of Chubut.²⁶ All of the existing genera with leaves like the fossil find their home in the warmer parts of South America, and none extend farther southward than northern Argentina.

Occurrence.—About 3 miles north of Estancia Chalia, Rio Chalia, Territory of Santa Cruz.

Cotypes.—Cat. No. 37873 U.S.N.M.

Order PERSONALES

Family BIGNONIACEAE

Genus BIGNONITES Saporta

BIGNONITES CHALIANUS, new species

Plate 5, Figure 6

Leaflets of medium size, ovate, widest medianly and about equally pointed at the apex and base. Margins entire. Texture subcoriaceous. Length about 7 centimeters. Maximum width about 3.5 centimeters. Midvein stout, prominent. Secondaries about 5, mediumly stout camptodrome pairs; the basal pair are stoutest and opposite and run close to and parallel with the lower lateral margins to the middle of the leaf, simulating lateral primaries. Tertiaries thin, usually forming a double series of meshes between adjacent secondaries.

This form presents features allying it with various existing genera of Bignoniaceae of the existing flora in the warmer parts of South America. Several genera range southward as far as northern Argentina.

²⁵ Engelhardt, H., *Abh. Senck. Naturf. Gesell.*, vol. 16, Heft 4, p. 680, pl. 9, fig. 6, 1894.

²⁶ Berry, Edward W., *Johns Hopkins University Studies in Geology*, No. 5, pp. 185-252, pls. 1-9, 1922.

Occurrence.—Three miles north of Estancia Chalia and $1\frac{1}{2}$ miles south of Mata Amarilla, upper Rio Chalia, Territory of Santa Cruz.

Holotype.—Cat. No. 37874, U.S.N.M.

DICOTYLEDONAE INCERTAE SEDIS

PHYLLITES NIRIHUAOENSIS, new species

Plate 3, Figures 18, 19

Leaf or leaflet tiny, orbicular in outline, with large irregular crenate teeth. Length 6 millimeters. Maximum width 4.5 millimeters. Apparently sessile. Venation relatively enormously stout and prominent. Midvein flexuous, terminating in an apical tooth. Secondaries 3 or 4 on each side, alternate, stout, often forking, recurving as marginal veins in the teeth. Areolation irregular and mostly rectangular, gradually diminishing in strength.

This typical form is based on the single specimen figured. It is somewhat similar to a slightly larger fragment from Barancas de Carmen Sylva, recorded by Dusén as *Escaloniiphyllum* species.²⁷ The venation suggests a relationship with the Cunoniaceous genus *Weinmannia*, but this resemblance does not warrant a decision.

Occurrence.—Southeast side of Rio Nirihuao, 150 yards southwest of Casa Piedra and about 12 miles south of Lago Nahuel Huapi, Territory of Rio Negro.

Holotype.—Cat. No. 37876, U.S.N.M.

PHYLLITES MOLLINEDIAFORMIS, new species

Plate 3, Figure 16

Leaf small lanceolate, coriaceous, with toothed margin and craspedodrome secondaries. Based on the single specimen figured and possibly representing a narrow *Nothofagus*. Shows considerable resemblance to *Mollinedia seymourensis* Dusén²⁸ of Tertiary of Seymour Island, Antarctica.

Occurrence.—Southeast side of Rio Nirihuao, 150 yards southwest of Casa Piedra, about 12 miles south of Lago Nahuel Huapi, Territory of Rio Negro.

Holotype.—Cat. No. 37877, U.S.N.M.

PHYLLITES species (cf. SCHINOPSIS)

Plate 3, Figures 10 to 12

More or less complete specimens of small linear-lanceolate leaves or leaflets are not uncommon at this locality. They do not show suf-

²⁷ Dusén, P., Svenska Exped. Magellansländerna, vol. 1, No. 4, p. 102, pl. 11, fig. 5, 1899

²⁸ Dusén, P., Schwed. Südpolar-Exped., vol. 3, Lief. 3, p. 4, pl. 1, fig. 18, 1908.

ficiently characteristic features to warrant even a surmise as to their botanical affinity. They may be briefly characterized as follows: Outline linear lanceolate, widest medianly, acutely and about equally pointed at the apex and base. Margins entire. Texture relatively coriaceous. Length 4 to 5 centimeters. Maximum width 2.75 to 7 millimeters. Petiole stout, about 3 millimeters in length. Midvein mediumly stout. Balance of the venation obscure; a few thin oblique camptodrome secondaries can be made out, thus ruling out comparisons with members of the family Myrtaceae, which are represented in most South American Tertiary floras, including that described from the supposed Santa Cruz beds of the Territory of Chubut.²⁹ They might represent the leaflets of some Sapindaceous genus, and they are also not unlike those of the Anacardiaceous genus *Schinopsis*, which is represented by good material from the Miocene of Chubut.³⁰

Occurrence.—Southeast side of Rio Nirihuaio, 150 yards southwest of Casa Piedra, about 12 miles south of Lago Nahuel Huapi, Territory of Rio Negro.

Cat. No. 37878, U.S.N.M.

PHYLLITES species 6 Dusén (?)

Phyllites, sp. 6. DUSÉN, Schwed. Südpolar Exped., vol. 3, lief. 3, p. 18, pl. 1, fig. 3, 1908.

A specimen indistinguishable from the one recorded by Dusén from the Tertiary of Seymour Island, Antarctica, but too fragmentary to be reliable, is present in the collection from near Mata Amarilla, upper Rio Chalia, Territory of Santa Cruz. Cat. No. 37879, U.S.N.M.)

²⁹ Berry, Edward W., Johns Hopkins University Studies in Geology, No. 3, p. 225, pl. 2, fig. 6, 1925.

³⁰ Idem, p. 208, pl. 1, fig. 2.

EXPLANATION OF PLATES

PLATE 1

- FIG. 1. *Filicites* species 1.
2. *Filicites* species 2.
3. Sterile, and Fig. 4. Fertile pinna of *Pteris nirihuaensis*, new species $\times 3$.
5-7. *Adiantum patagonicum*, new species.
5. The most nearly complete specimen found.
6. Same, slightly restored, $\times 4$.
7. Enlarged segment of distal margin showing supposed sori.

PLATE 2

- FIG. 1. *Zamia australis*, new species.
2-4. *Fitzroya tertiaria*, new species.
2. Natural size.
3 and 4. Enlarged $\times 5$.
5, 6. *Araucaria nathorsti* Dusén.
7-9. *Nothofagus simplicidens* Dusén.
10. *Peumus clarki* Berry.
11. *Rollinia* (?) *patagonica*, new species.

PLATE 3

- FIGS. 1-9. *Myrcia nitens* Engelhardt.
10-12. *Phyllites* species (cf. *Schinopsis*).
13, 14. *Leguminosites calliandraformis*, new species 14 enlarged $\times 4$.
15. *Scirpites* species Dusén (?)
16. *Phyllites mollinediaformis*, new species.
17. *Leguminosites* species.
18, 19. *Phyllites nirihuaensis*, new species 19 enlarged $\times 10$.

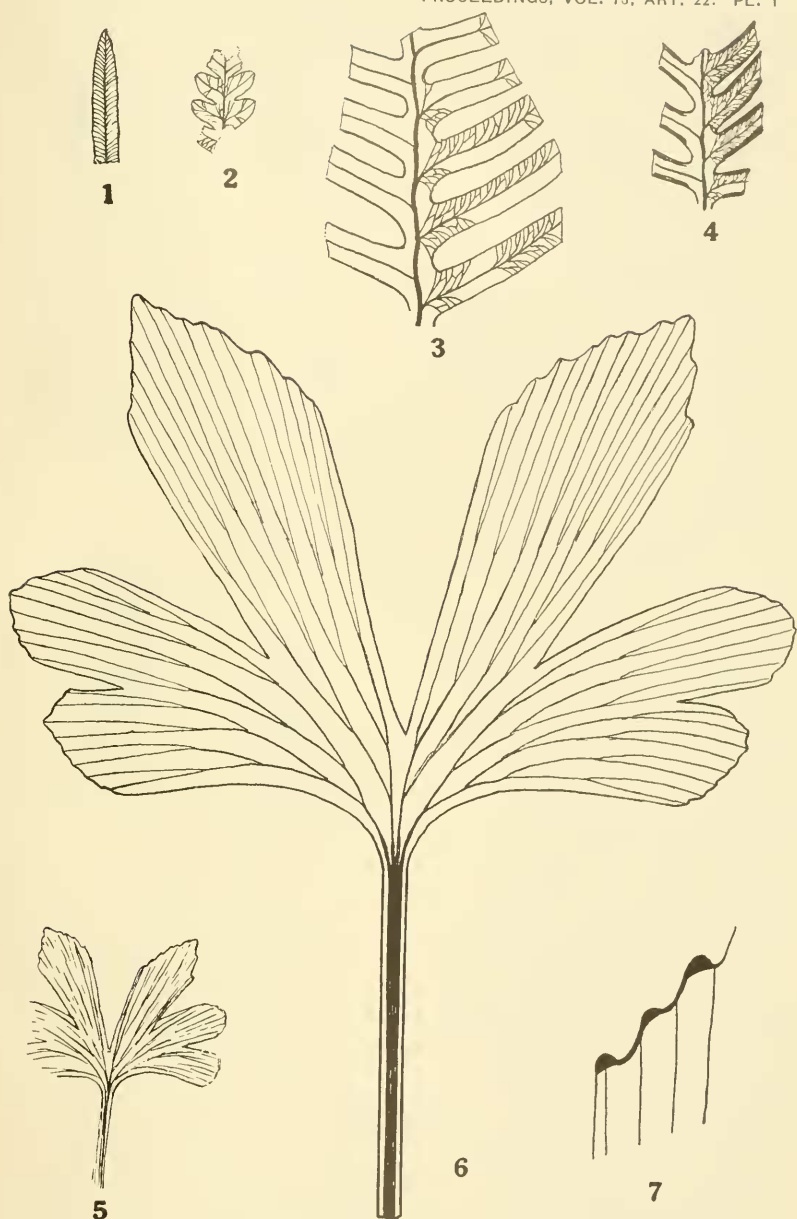
PLATE 4

- FIGS. 1-7. *Sterculia washburnii*, new species.

PLATE 5

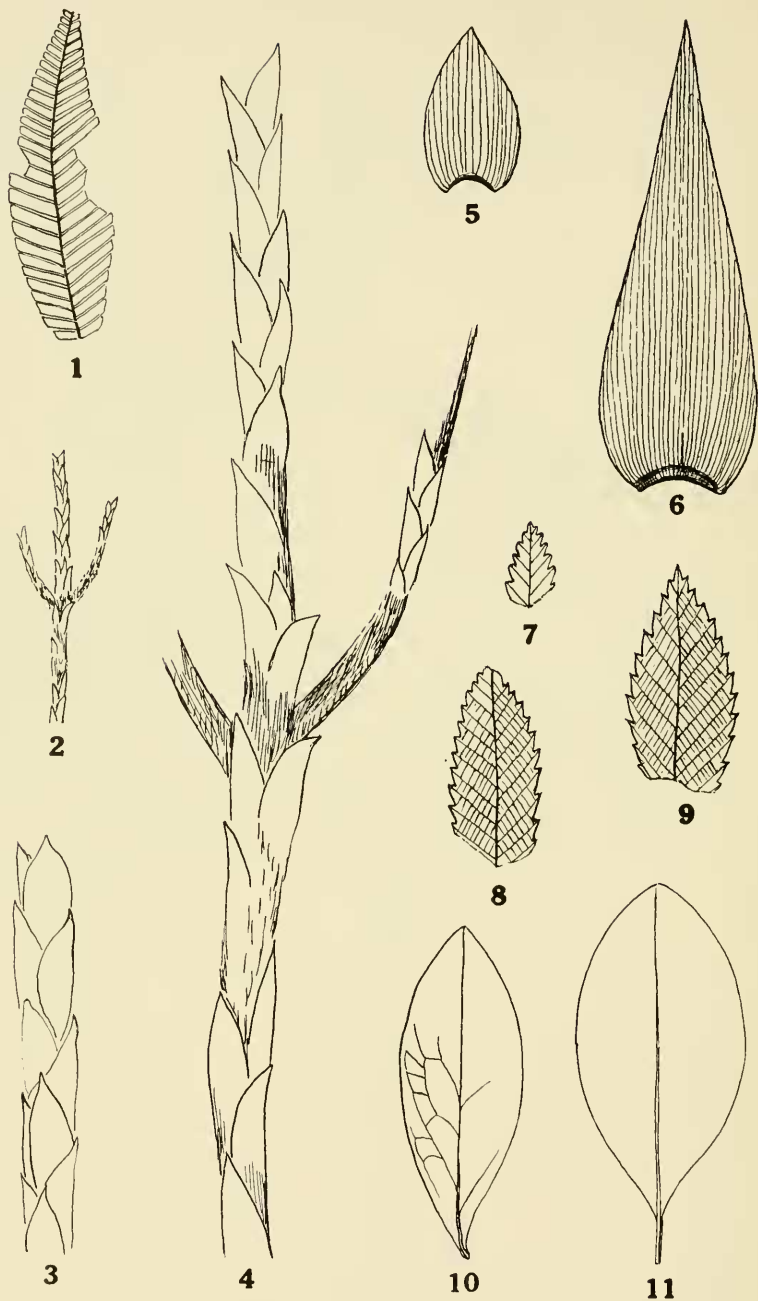
- FIG. 1. *Anacardites* (?) *patagonicus*, new species.
2. *Hydrangea* (?) *incerta*, new species.
3. *Laurelia amarillana*, new species.
4. *Laurophyllum chalianum*, new species.
5. *Apocynophyllum chalianum*, new species.
6. *Bignonites chalianus*, new species.





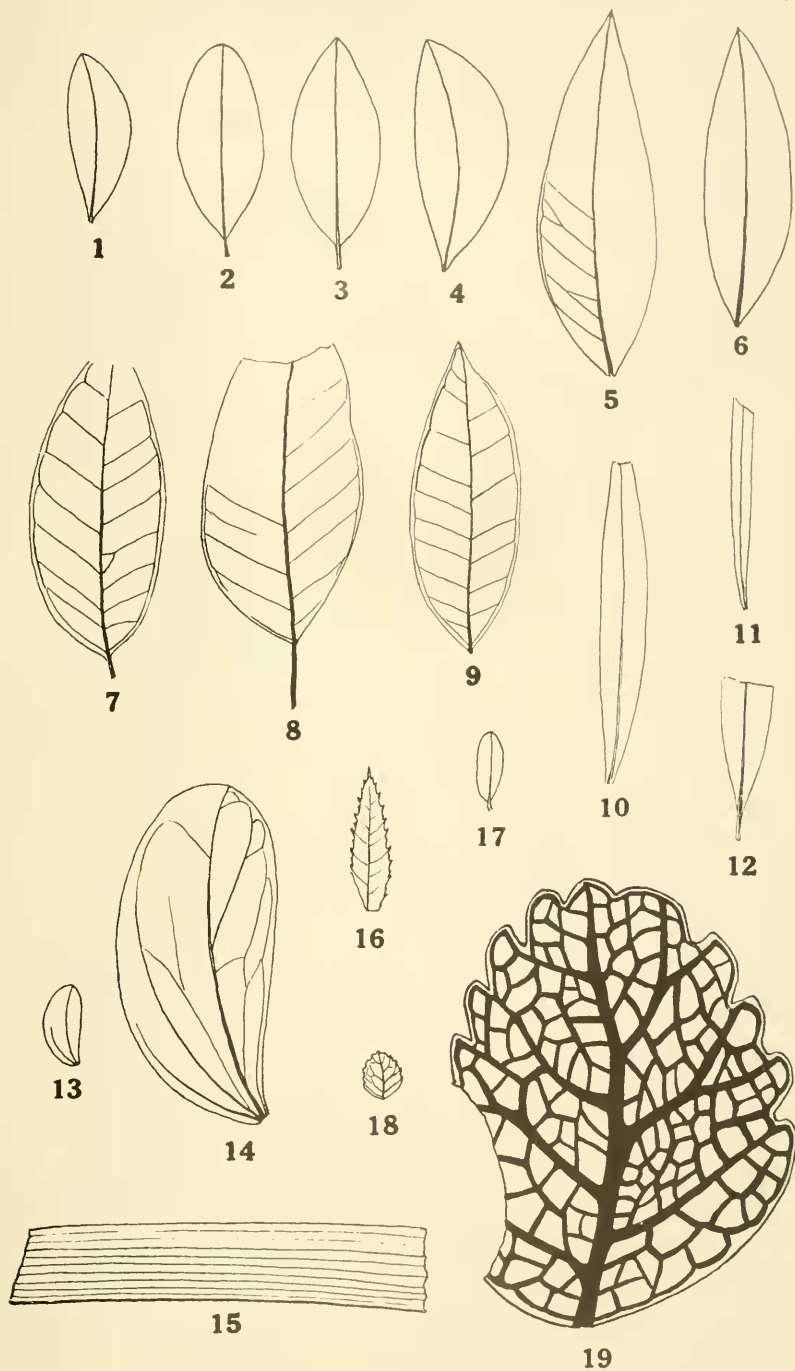
ARGENTINE TERTIARY PLANTS

FOR DESCRIPTION OF PLATE SEE PAGE 27



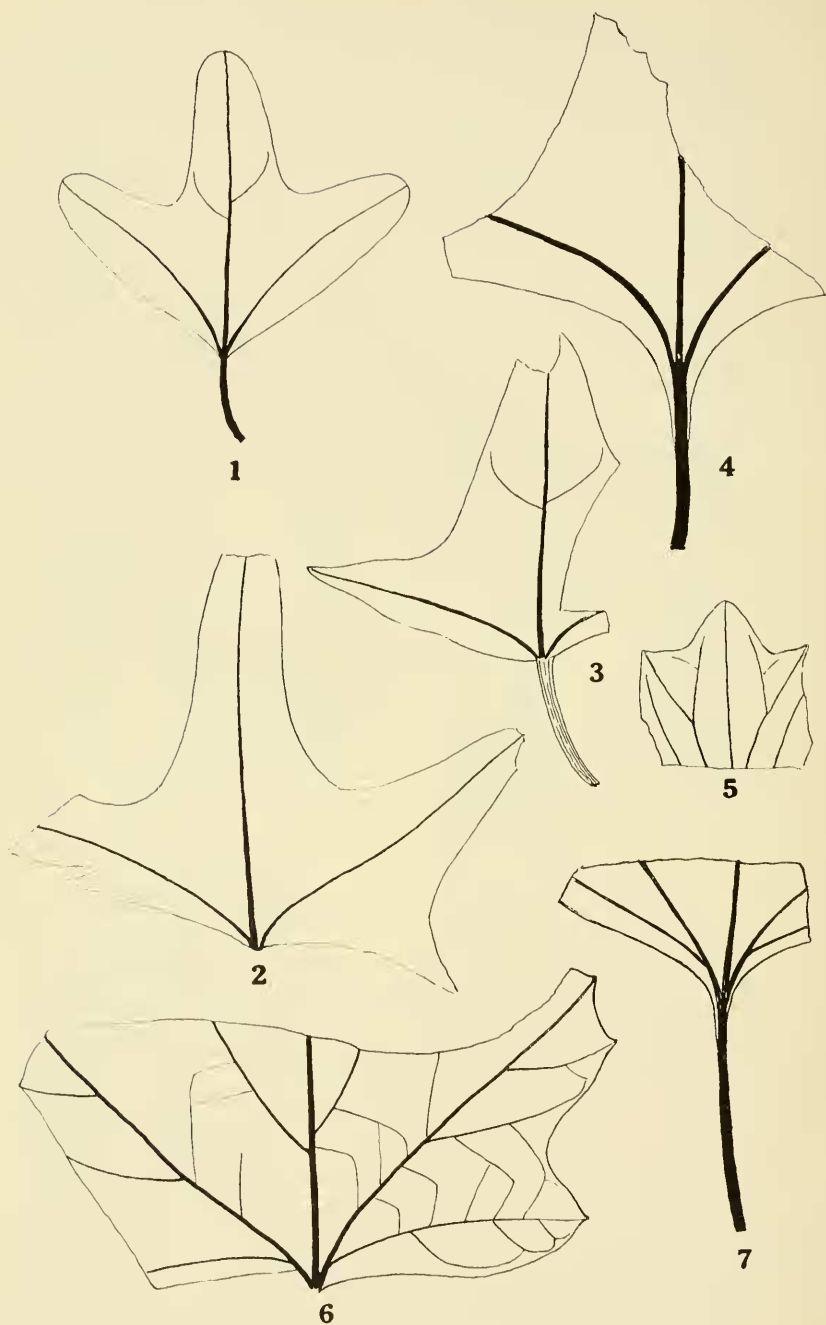
ARGENTINE TERTIARY PLANTS

FOR DESCRIPTION OF PLATE SEE PAGE 27



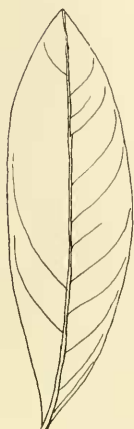
ARGENTINE TERTIARY PLANTS

FOR DESCRIPTION OF PLATE SEE PAGE 27



ARGENTINE TERTIARY PLANTS

FOR DESCRIPTION OF PLATE SEE PAGE 27



1



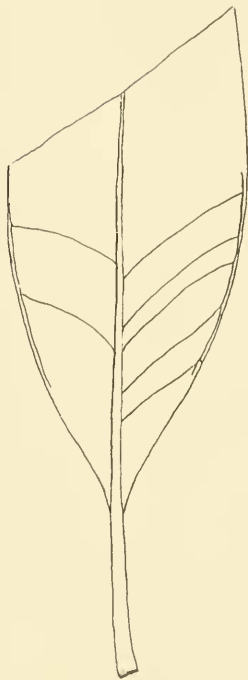
2



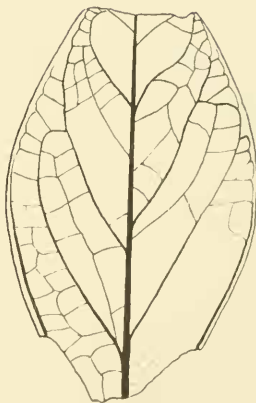
3



4



5



6

ARGENTINE TERTIARY PLANTS

FOR DESCRIPTION OF PLATE SEE PAGE 27

NOTES ON AMERICAN TWO-WINGED FLIES OF THE FAMILY SAPROMYZIDAE

By J. R. MALLOCH

Of the Biological Survey, United States Department of Agriculture

Through a coincidence Dr. F. Hendel and the present writer recently published papers¹ dealing with South American Sapromyzidae. Doctor Hendel included all the genera of the family known to him, while I dealt only with South American species. As some of the new genera erected contain species which are not rare, it is not remarkable that several synonyms resulted, and those which I am certain of are noted below.

Genus NEOMINETTIA Hendel

This generic name was proposed by both authors (Malloch, p. 9), and *contigua* Fabricius was cited as genotype by both. As Hendel's paper antedates mine, the genus should be credited to him.

Genus DRYOMYZOTHEA Hendel

My genus *Dryomyzoides* is the same as this, but my genotype, *advena* Malloch, is apparently distinct from his, *setinervis* Hendel.

Genus DEUTOMINETTIA Hendel

This genus was erected for a species, *pulchrifrons* Hendel, which has most of the characters of *Minettia* Robineau-Desvoidy, differing in having the scutellum haired on the disk. I have before me a species which is evidently referable to the genus; and though the face is a little more convex than in normal *Minettia*, it is not so much so that I would place it in the group with markedly convex face. I have not seen the genotype, so can not say whether it has the mid tibia with well-developed bristles on the posterior surface; but if it has, and its similarity to the other included species leads me to believe so, it might be better to base the generic distinction on

¹ Hendel, *Encyclopédie Entomol.*, Diptera, vol. 2, pp. 103-142, 1925, and Malloch, *Proc. U. S. Nat. Mus.*, vol. 68, art. 21, pp. 1-35, 1926.

definite decision as to the identity of Macquart's species may depend upon the discovery of his type.

DEUTOMINETTIA APPROXIMATA, new species

Male.—Glossy fulvous yellow, the center of frons shining; antennae and palpi yellow. Both cross veins of wings distinctly, but not broadly, clouded, costa apically slightly suffused with brown.

Anterior orbital bristles over half as long as posterior pair; ocellars minute; postverticals long; arista plumose; face almost flat, glossy, orbits whitish dusted. Thoracic bristles long and strong, anterior sternopleural very short and fine. Mid tibia with about seven short posterior bristles; mid femur without anteroventral bristles. Inner cross vein a little beyond middle of discal cell.

Length, 6 mm.

One male, Trinidad River, Panama, May 2, 1911 (A. Busck).

Type.—Cat. No. 40965, U.S.N.M.

DEUTOMINETTIA BIMACULATA, new species

Male and female.—Testaceous yellow, distinctly shining. Orbital stripes glossy, ceasing at anterior orbitals, a velvety deep black mark on each side from anterior orbital to anterior margin of frons which extends posteriorly, forming a wedge-shaped mark between orbit and eye almost as far as posterior bristle; parafacials silvery. Abdomen with a faint dark apical line on each tergite in male. Legs yellow. Wings hyaline. Halteres yellow.

Frons slightly widened anteriorly, with some microscopic surface hairs, all bristles long and strong; arista plumose; face slightly bulging out over mouth, a little convex; eye narrowed below, slightly emarginate on lower half behind; two strong bristles on lower part of occiput. Thorax with three postsutural dorsocentrals, about eight series of introdorsocentral hairs, the intra-alar strong, disk of scutellum black setulose, and the anterior sternopleural bristle very weak. Fore femur without an anteroventral comb; all tibiae with preapical dorsal bristle, mid pair each with a series of eight or more distinct posterior setulae. Inner cross vein of wing close to middle of discal cell; apical section of fourth vein but little longer than preceding section; first posterior cell slightly narrowed apically.

Length, 6–7 mm.

One male, Trinidad Rio, Panama, May 1, 1911; allotype and one male paratype, same locality, March 16 to 23, 1912 (A. Busck).

Type.—Cat. No. 40708, U.S.N.M.

Genus ASILOSTOMA Hendel

This genus was erected for the reception of a single species, *enderleini* Hendel, from Bolivia. Before me there is a species undoubt-

edly belonging to this genus, and another which agrees with the general description of the genotype, but differs in the bristling of the vertex and in some other respects. I deprecate the erection of monobasic genera and, as I find included in some related genera species which differ in a similar manner, I do not propose to erect a new genus for the species now before me.

All of the species have the basal and second antennal segments of about the same length, the first haired below, the third not less than six times as long as wide at middle, the arista plumose, face prominently protruded and convex, thorax with two pairs of postsutural dorsocentrals, no presutural (posthumeral), and one sternopleural; scutellum bare, flattened above, and with four bristles. The venation is different in *palpalis* from that of the other species. In three the wings are marked with fuscous, and the second, third, and fourth segments of fore tarsi of all five are compressed.

I present below a key for the identification of the species, the genotype being unknown to me except from the description.

KEY TO THE SPECIES OF ASILOSTOMA

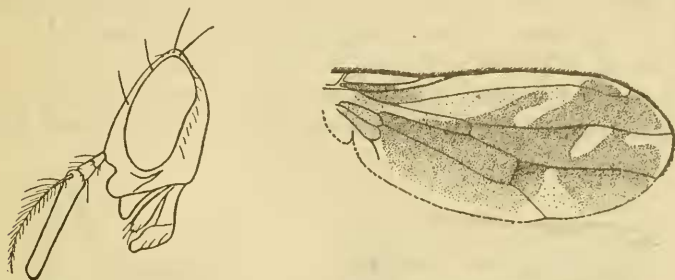
1. Distance from bases of antennae to lower margin of face not half as great as that from bases of antennae to vertex; frons testaceous yellow, except the dark ocellar spot, face concolorous, the lower lateral angles and most of the cheeks glossy black; labrum large, its area almost as great as that of face, glossy black; palpi deep black, and much dilated; anterior pair of orbital bristles about as long as posterior pair, and close to middle of frons.
palpalis, new species.
- Distance from bases of antennae to lower margin of face not much less than that from bases of antennae to vertex; frons and face black; labrum narrow; palpi slender.....2
2. Anterior pair of orbital bristles not half as long as posterior pair; legs entirely stramineous.....3
- Anterior pair of orbital bristles fully as long as posterior pair; legs yellow, fore tibia and fore metatarsus, except apex of latter, black.
enderleini Hendel.
3. Frons and face glossy black.....*pallipes*, new species.
- Frons with a large velvety black mark in front, the remainder glossy black...4
4. Face entirely glossy black.....*atriceps*, new species.
- Face and cheeks entirely glossy yellow.....*flavifacies*, new species.

ASILOSTOMA PALPALIS, new species

Male.—Head shining testaceous yellow, ocellar spot, a large mark on each side of upper half of frons, and the lower lateral angle of face and contiguous portion of each cheek, black; upper side of basal segment of antennae, and the third segment except base fuscous; palpi black, arista yellow, the hairs brownish. Thorax and abdomen brownish yellow, a dark streak over each humerus, and a velvety black vitta along upper half of pleura and sides of abdomen.

Legs testaceous yellow, a mark on apices of fore femora, another near bases of fore tibiae, and the fore metatarsi except their apices, black, the dilated portion of fore tarsi whitish. Wings marked with fuscous as in Figure 2.

Frons fully twice as long as wide, the surface uniform in texture; ocellars microscopic; cheek almost linear; face concave below antennae, the lower half prominently convex (fig. 1); third antennal segment about seven times as long as its width at middle. Thorax appearing finely granulose on dorsum, with two or three closely placed series of microscopic intradorsocentral hairs, and a series of similar hairs in line with each series of dorsocentrals; prescutellar acrostichals lacking. Fore femur without bristles or anteroventral



FIGS. 1-2.—1. HEAD OF ASILOSTOMA PALPALIS FROM SIDE. 2. WING OF ASILOSTOMA PALPALIS

comb; tibiae with the preapical dorsal bristle very short except on mid pair. Venation as in Figure 2.

Length, 5.5 mm.

One male, Barro Colorado, Panama Canal Zone, July 27, 1923 (R. C. Shannon).

Type.—Cat. No. 40710, U.S.N.M.

ASILOSTOMA PALLIPES, new species

Female.—Head glossy black, antennae testaceous, third segment black except extreme base; aristae and the hairs, except those on basal half on upper side, white; palpi fuscous. Thorax colored as in *palpalis*, but without black markings. Abdomen brownish black. Legs entirely pale yellow. Wings marked with fuscous as in Figure 3. Halteres yellow.

Frons a little longer than wide, posterior orbitals about middle of frons, and fully twice as long as anterior pair; antennae as in *palpalis*; face but slightly concave below antennae, and quite prominently convex below, much as in genotype, the labrum narrow, cheek about as high as width of third antennal segment. (Fig. 4.) Thorax not so long as in *palpalis*, the anterior pair of dorsocentral bristles much

nearer to suture, and the intradorsocentral hairs farther apart. Fore femora with two or three fine posteroventral bristles. Venation as in Figure 3.

Length, 3.5 mm.

One female, Trinidad Rio, Panama, March 23, 1912 (A. Busck).

Type.—Cat. No. 40709, U.S.N.M.

ASILOSTOMA ATRICEPS, new species

Female.—Head black, upper portion of frons to below the upper orbital bristle on sides and to a point a little higher in middle distinctly shining, anterior portion deep velvety black, with a white dusted mark on each margin above level of bases of antennae; face glossy, with a purple tinge; basal two antennal segments testaceous yellow, third fuscous; aristae white, the long hairs at base above dark; palpi fuscous. Thorax pale brown, more or less dusted on dorsum and not noticeably shining except on sides of mesonotum, propleura, scutellum, and metanotum testaceous yellow, a large mark in front



FIGS. 3-4.—3. WING OF *ASILOSTOMA PALLIPES*. 4. HEAD OF *ASILOSTOMA PALLIPES* FROM SIDE

of each wing base velvety black. Abdomen brown, shining. Legs pale stramineous, the fore tarsi palest. Wings grayish hyaline, with faint brown clouds along fifth vein, outer cross vein, apex of second vein, and on a short subapical section of third and fourth veins. Halteres yellow.

Vertex with inner pair of bristles long and strong, outer pair lacking, postverticals minute, anterior orbital bristles very small; third antennal segment about six times as long as wide; arista long haired basally above, the hairs decreasing rapidly in length apically, the lower side short haired; face in type damaged, but evidently not so much swollen as in some of the other species. Thorax normal, the two pairs of dorsocentral bristles long and strong. Legs long, fore tarsi thickened. Inner cross vein a little beyond middle of discal cell; second vein slightly arched with costa, third and fourth slightly convergent on apical sections to near apices.

Length 2.75 mm.

One female, Higuito, San Mateo, Costa Rica (P. Schild).

Type.—Cat. No. 40954, U.S.N.M.

ASILOSTOMA FLAVIFACIES, new species

Female.—Head as in preceding species but the face and cheeks are honey yellow. The thorax is colored as in *atriceps* but the anterior margin is more yellowish and vittate, and the sternopleura is yellow, not dark, and the dark mark on sides of metathorax is deeper black. Abdomen shining fuscous. Wings with but faint indications of the cloud on fifth vein and outer cross veins, none on apices of other veins.

Structurally similar to *atriceps*.

Length, 3 mm.

Type and one defective paratype, Higuito, San Mateo, Costa Rica (P. Schild.).

Type.—Cat. No. 40955, U.S.N.M.

Genus BLEPHAROLAUXANIA Hendel

This genus has the base of third vein setulose to beyond the inner cross vein, the face convex below, and two pairs of normal backwardly inclined orbitals. The most striking character of the genus is the presence of fine hairs on the upper surface of the third antennal segment which are as long as, or longer than, the width of the segment itself. There is no other genus except the next following one so far described in which such hairs occur.

BLEPHAROLAUXANIA TRICHOCERA Hendel

This is the only known species of the genus, and occurs in Peru. It is a yellow species, with the wing veins mostly browned. The arista is very long haired and the thorax has three pairs of postsutural dorsocentrals.

I have not seen the species.

Genus PLATYGRAPHIUM Hendel

This genus lacks the presutural (posthumeral) bristle, has the third antennal segment three times as long as wide, and long haired on upper surface as in the preceding genus. It differs from that genus in having no presutural bristle, the third wing vein without bristles, and the arista with the hairs about half as long as width of third antennal segment. *Platygraphium penicillatum* Hendel is the only known species, and it is recorded only from Bolivia. It is yellow in color, with the abdomen browned, and has the wings grayish hyaline, with the base and costa yellowish. It is unknown to me.

Genus ERIURGUS Hendel

This genus lacks the presutural bristle, has the wing veins without bristles, and the third antennal segment orbicular and without hairs

above. The distinguishing character is the presence of long fine hairs on the posterior and ventral surfaces of the fore femora and tibiae. *Eriurgus pilimanus* Hendel is the only known species of the genus and occurs in Peru. It is entirely yellow in color and similar in most respects to *Dryomyzotha setinervis* Hendel.

The genotype from which the description was made is a male and it is possible the female may not have long hairs on the forelegs.

Genus ALLOMINETTIA Hendel

For discussion of this genus see under *Deutominettia* in this paper.

Genus SCUTOLAUXANIA Hendel

This genus has the scutellum with hairs above, and the stem of veins 2 and 3 setulose as in *Xenochaetina* Malloch. The thorax has two pairs of postsutural dorsocentrals, and the arista is long haired. *Scutolauxania piloscutellaris* Hendel is the only known species of the genus; it occurs in Peru. A yellow species resembling *Allogriphoneura nigromaculata* Hendel except that there are no black spots at apex of the scutellum. It is unknown to me.

Genus RHABDOLAUXANIA Hendel

There are very slight distinctions given for this genus, the principal being the lack of ocellar bristles, and the very strong orbitals, of which the anterior pair is longest. *Rhabdolauxania schnusei* Hendel, is a yellow species, with six dark spots on each wing, the one at apex of second vein being very large. Bolivia and Peru. *Rhabdolauxania laevifrons* Hendel, is a smaller species, with less conspicuously marked wings, the spot at apex of second vein being very small. Peru.

FREYIA, new genus

This genus resembles *Lauxania* Latreille in many respects, but is readily distinguished from it by the much shorter third antennal segment, slightly incurved anterior orbitals, very short ocellars, conspicuous transverse depression below middle of face, lack of presutural (posthumeral) bristle, and the presence of but one pair of postsutural dorsocentrals and no acrostichals. The sixth wing vein is also extremely short, barely extending beyond anal cell. In Hendel's key it runs to *Asilostoma* but it is readily distinguished from it by the shape of the head, presence of but one pair of dorsocentrals, etc.

I dedicate the genus to Dr. R. Frey, who has done some fine work in this and related families of Diptera.

Genotype.—The following species.

FREYIA NIGRITA, new species

Female.—Glossy black, convex upper portion of face brownish yellow, third antennal segment at insertion of arista, and base of latter, yellow; arista apically, and its hairs, white; fore legs with the trochanters, basal two-thirds of femora, and extreme bases of tibiae, yellow; mid and hind tibiae and tarsi yellow, apices of the tibiae black. Wings yellowish, slightly darker at bases. Knobs of halteres black.

Head in profile as Figure 5; frons uniform in texture, anterior orbitals slightly incurved, almost as long as, but much finer than, posterior pair; basal and second antennal segments equal in length, the former not haired below; hairs on arista rather dense, and about half as long as width of third antennal segment; postverticals rather short; outer verticals about half as long as inner pair. Surface hairs on mesonotum sparse and short; anterior sternopleural weak; scutellum slightly flattened above, rounded in outline, basal bristles shorter than apical pair. Fore legs slightly thickened, the femur with 2-3 bristles on apical half of posteroventral surface and no anteroventral comb; all tibiae with preapical dorsal bristle. Inner cross vein close to middle of discal cell, outer one at fully its own length from apex of fifth vein; penultimate section of fourth vein less than one-third as long as ultimate.

Length, 3 mm. exclusive of antennae.

One female, Higuato, San Mateo, Costa Rica (P. Schild.).

Type.—Cat. No. 40879, U.S.N.M.

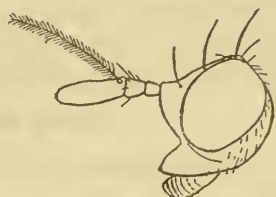


FIG. 5.—HEAD OF FREYIA NIGRITA FROM SIDE

Genus HALIDAYELLA Hendel

This generic name was proposed by Hendel as a substitute for *Calliope* Haliday, the latter being preoccupied.

When my previous papers were written I was uncertain of the characters of *Calliope*, and referred the American species *flaviceps* Loew to the genus. Hendel cites *aenea* Fallen as the genotype of *Halidayella*, the sole original species of *Calliope*, *scutellata* Meigen, being a synonym of this; and I have that species, *elisae* Meigen, and *atrocaerulea* Becker, before me now. These species have the face entirely glossy black, distinctly convex on upper half, and with a transverse depression at middle, below which it is almost flat or slightly convex; the thorax has three pairs of strong postsutural dorsocentrals and no intra-alar; and the frons is shining, with the orbits broad, and but poorly distinguished from the interfrontalia. In the males of these species there is a dense patch of short black

setulae at apices of ventral surfaces of the hind tibiae. I have not seen the female of any of the three species.

I have seen no species of the genus from America, so the genus should be deleted from our list.

PSEUDOCALLIOPE, new genus

This genus has the face evenly convex, without a transverse depression near middle; the frons almost uniformly glossy; the arista pubescent; thorax with the anterior one of the three pairs of post-sutural dorsocentrals reduced in size, and a short but distinct intra-alar present.

Genotype.—*Lauzania flaviceps* Loew.

The presence of the intra-alar bristle and lack of a transverse impression of face, and a ventral patch of setulae on hind tibia, distinguish the genus from *Halidayella* to which it runs in Hendel's key to the genera of the world.

The species described as *Minettia verticalis* in this paper resembles *flaviceps* in some respects, but the face and frons are not glossy, and the former is not so noticeably convex.

Genus MINETTIA Robineau-Desvoidy

Minettia ROBINEAU-DESVOIDY, Myodaires, 1830, p. 646.

I described several species of this genus in the paper already referred to but gave no synoptic key. Doctor Hendel also described a few species in his paper. Below I am presenting a key to the species which I have been able to identify, but there are no doubt many more which are unknown to me, so that care must be exercised in using it for identifications. I omit the North American species which do not occur south of the United States so far as I know.

I have included *Sapromyza schwarzii* Malloch in the key because it may be confused with this genus by those not well versed in the generic distinctions.

KEY TO THE SPECIES OF MINETTIA

1. Face yellow, with at least a black central spot on lower margin; scutellum with a black spot at base of each of the apical bristles, which may sometimes be continued forward toward base of scutellum, forming two dark vittae.....2
- Face either black or yellow, if yellow and with a black central spot the scutellum is without black apical spots.....8
2. Wings with at most the cross veins slightly clouded, no other markings present.....3
- Wings with quite conspicuous dark markings in addition to any on cross veins.....6
3. Mesopleura and sternopleura each with a small round black spot; antennae entirely yellow.....slossonae Coquillett.
- Pleura with, or without, two partial blackish vittae, no round black spot on the mesopleura.....4

4. Palpi and antennae yellow-----*zebroides* Hendel.
Palpi black at apices-----5
5. Antennae entirely yellow; a brown mark on each cheek.
octopunctata Wiedemann.
Basal two antennal segments black, third yellow; no dark mark on cheek,
but one on each side of labrum below eye-----*picticornis* Coquillett.
6. Face with a round black spot above middle on each side and one in center of
lower margin; a blackish spot on each cheek below eye; basal two antennal
segments black-----*tripuncticeps* Malloch.
Face with but one black mark, in center of lower margin; no dark mark
on cheek; antennae entirely yellow-----7
7. Thorax with four blackish vittae; a dark mark about middle of apical section
of fourth vein-----*octovittata* Williston.
Thorax without dark vittae; no dark spot near middle of apical section of
fourth vein, but one at its apex-----*evittata* Malloch.
8. Face yellow, with a black central mark-----9
Face either entirely yellow or entirely black-----10
9. Forelegs and antennae testaceous yellow; thorax usually very faintly vittate.
valida Walker.
Forelegs black from apical third of femora to apices of tibiae; antennae
fuscous, base of third segment yellowish; thorax conspicuously quadri-
vittate with black on dorsum-----*Sapromyza schwarzi*, new species.
10. Scutellum yellow, with a black spot at base of each apical bristle-----11
Scutellum black or yellowish, without evident black apical spots-----14
11. Wings hyaline; mesonotum with four large black spots.
nigripunctata, new species.
- Wings partly infuscated; mesonotum without black spots-----13
12. Wing marked almost exactly as in *Neominettia contigua* Fabricius, with two
brown spots on third vein between inner cross vein and apex which are
connected with the broad brown costal streak, a conspicuous cloud over
each cross vein, and one on apex of third vein and another on apex of
fourth, the two last connected along costa with the costal cloud.
tucumanensis, new species.
- Wing without evident spots on third vein between inner cross vein and
apex-----12
13. Wings broadly brown on costal region, the infuscation extending almost to
third vein up to a point nearly in line with outer cross vein, and over third
vein from there to apex, the fourth and fifth veins not narrowly clouded;
abdomen with a central black spot on fourth and fifth tergites, and with-
out conspicuous lateral apical black marks-----*bipunctata* Say.
- Wings narrowly dark brown along costa from apex of auxiliary vein to apex
of fourth, more broadly so on both cross veins, narrowly brown on third
and fourth veins from inner cross vein to apices, and on fifth from near
base to apex; abdominal tergites each with a narrow, centrally interrupted,
black fascia on apical margin, broadest on sixth tergite, where it forms a
large spot on each side, no central black spot present-----*tinctinervis* Malloch.
14. Thorax black or brownish black; arista long haired-----15
Thorax yellow, sometimes with black spots or vittae; if dark brown the
arista is only pubescent-----16
15. Thoracic dorsum velvety black and faintly vittate; scutellum brown on mar-
gin and slightly shining; abdomen with white, almost silvery, dust on
basal three tergites; only two pairs of dorsocentral bristles on thorax;
wings black at extreme bases-----*argentiventris*, new species.

Thorax and abdomen shining black, the former thinly bluish grey dusted, not vittate, scutellum not paler on margin than on disk; two strong, and one very weak, pairs of dorsocentral bristles present behind suture; wings slightly and almost uniformly infuscated, the extreme bases of veins yellowish.....*infuscata*, new species.

16. Wings either largely infuscated or with well-defined dark markings in addition to any that are present over the cross veins.....17

Wings hyaline, with at most clouds over the cross veins, and rarely with a slight costal suffusion but no distinct markings; arista plumose.....20

17. Yellow species, with clean-cut markings on the wings; arista short haired.....18

Dark brown species, with the wings intensely brown on costa and gradually becoming less dark posteriorly, but with no well-defined markings; arista bare or pubescent.....19

18. Thoracic dorsum with two blackish vittae which extend to apex of scutellum, the pleura with two similar vittae, one on upper margin and the other on upper margin of sternopleura; wings marked with black as follows: A costal streak from base extending to over second vein and running obliquely across cross wing to hind margin in second posterior cell covering all of apex of wing, a cloud over inner cross vein, and another over outer one, the latter extending to apex of fifth vein and back along that vein almost to base of discal cell; in the large apical dark portion there are three hyaline spots, one in submarginal cell and two in first posterior cell; legs conspicuously marked with black.....*geminata* Fabricius.

Thorax entirely yellow; wings each with six large blackish spots, three along costa, all of which extend more narrowly to third vein, the basal one inclosing the inner cross vein, one at apex over tips of veins 3 and 4, sometimes divided into two, one over outer cross vein and one in fifth vein just beyond middle of discal cell; legs yellow, with extreme apices of hind femora black.....*quadrata*, new species.

19. Anterior one of the three pairs of postsutural dorsocentrals distinctly proximal of middle of mesonotum, and distinctly closer to the suture than to the posterior pair; vertex not abnormally setulose.

.....*brunneicosta*, new species.

Anterior one of the three pairs of postsutural dorsocentrals distinctly behind the middle of mesonotum, and about as close to posterior pair as to suture; vertex much more strongly and numerously setulose than usual.

.....*verticalis*, new species.

20. Cross veins of wings very faintly clouded; species but slightly shining; mid tibia with about seven short regular posterior setulae; hind femur with at least one preapical anteroventral bristle.

.....*Deutominettia geniseta* Malloch.

Cross veins of wings quite distinctly infuscated; species distinctly shining.....21

21. Costa without any trace of a dark suffusion; mid tibia with about three rather long posterior bristles; hind femur with at least one evident preapical anteroventral bristle.....*Deutominettia assimilis* Malloch.

Costa with a slight trace of a dark suffusion apically; mid tibia with about seven short regular posterior setulae; hind femur without an evident preapical anteroventral bristle.....*Deutominettia approximata*, new species.

NOTE.—I have included in the above key the three species lacking the scutellar setulae and without frontal black spots which I have now placed in *Deutominettia* in this paper as there is some question as to whether they belong to the latter or not. Only a thorough revision of the family by someone who has access to a much larger amount of material than either Hendel or I have will settle the matter of generic limits.

MINETTIA ZEBRA Hendel

This species appears to me to be the same as *tripuncticeps* Malloch, and though the description was evidently published prior to that of the latter the fact that *Minettia zebra* Kertész was described some years before should bar *zebra* as the name for the American species and validate *tripuncticeps*.

MINETTIA ZEBROIDES Hendel

The description of this species agrees with *picticornis* Coquillett in most particulars but the palpi are given as entirely yellow, which is not the case in that species.

MINETTIA NIGROPUNCTATA, new species

Male and female.—Pale testaceous yellow, with rather dense whitish dusting; antennae and palpi yellow, the thorax with eight large black spots as follows: One at suture laterad of each anterior dorso-central bristle, one between each posterior dorsocentral and pre-scutellar acrostichal, one on each side of scutellum occupying the space between the lateral and apical bristle, and one on each mesopleura at base of the bristle. Abdomen with a black central spot on one or two of the apical tergites. Legs yellow. Wings yellowish hyaline. Halteres pale.

Frons a little wider than long, narrowest behind, the orbits hardly differentiated, with the anterior bristle a little shorter than posterior and very slightly incurved at tip, postvertical bristles a little shorter than outer verticals, the latter about half as long as inner pair; ocellars very short and hairlike; no surface hairs on frons; face evenly convex; third antennal segment fully twice as long as wide; arista with its longest hairs about half as long as width of third antennal segment; cheek about half as high as eye. Thorax with three pairs of postsutural dorsocentrals, six series of intra-dorsocentral hairs, one pair of long prescutellar acrostichals, the intra-alar quite weak, four long scutellars, and one sternopleural; scutellum flattened above. Hypopygium of male quite large, lateral exposed portion about as wide and nearly as long as hind femur. Legs normal, all tibiae with a preapical dorsal bristle, fore femur without anteroventral comb. Inner cross vein a little beyond middle of discal cell; apical section of fourth vein a little over twice as long as preapical; outer cross vein at about its own length from apex of fifth vein.

Length, 3.5 mm.

Type.—Male, allotype, and three paratypes, Bolivia (Germain), in Deutsches Entomologisches Museum.

MINETTIA ARGENTIVENTRIS, new species

Male.—Head brownish black; frons velvety black, more brownish on orbits and a narrow central vitta, and with grayish dust at bases of the bristles; antennae brownish yellow; aristae fuscous, paler at bases; face slightly white dusted; occiput testaceous on each side of lower half, and with whitish dust; palpi fuscous. Thorax deep brownish black, almost velvety on dorsum, and when seen from the side and in front with dark vittae; some slight whitish dust round prothoracic spiracle; margin of the scutellum more brownish than disk and slightly shining. Abdomen brown, first to third visible tergites with white, almost silvery, dusting which is not very dense, and is most conspicuous when viewed from in front. Legs dark brown, the tarsi except their apices testaceous. Wings yellowish hyaline, black at extreme bases and on costal vein at apex of auxiliary vein. Halteres yellow.

Frons subquadrate, anterior orbitals hardly more than half as long as posterior pair, ocellars very short and fine, postverticals short; third antennal segment fully twice as long as wide, slightly narrowed at apex; arista plumose; face with a slight but distinct hump on each side below; palpi broad. Thorax with two pairs of strong postsutural dorsocentrals, one pair of prescutellar acrostichals, about 12 series of intradorsocentral hairs, one sternopleural, the prosternal plate broad and with microscopic hairs, the scutellum convex, rounded in outline, and with four bristles, the basal pair incurved, the apical pair divergent. Abdomen stout, apices of tergites 2 and 3 bristled. Legs normal, no anteroventral comb on fore femur. Inner cross vein at about three-sevenths from base of discal cell, penultimate section of fourth vein subequal to ultimate, the latter slightly forwardly sloped apically.

Length, 6 mm.

One male, near Para, Brazil (Miss H. B. Merrill).

Type.—Cat. No. 40711, U.S.N.M.

This species is readily distinguished from any black one by the white-dusted abdomen and its large size. It belongs to the segregate containing the genotype, in which there are two slight but evident humps on lower portion of the face.

MINETTIA INFUSCATA, new species

Female.—Head black, subopaque, slightly shining on frontal orbits, with pale gray dusting, most dense on face; antennae fuscous, base of third segment yellowish below; palpi fuscous. Thorax black, shining, the dorsum evenly and slightly gray dusted, and without vittae, pleura more densely gray dusted. Abdomen shining black, hardly dusted. Legs testaceous yellow, whitish dusted, femora

almost entirely blackened; apices of tarsi dark. Wings almost uniformly fuscous, paler along costa at base, and slightly hyaline along hind border basally. Halteres yellow.

Frons a little longer than wide, all the bristles except the ocellar pair long and strong; antennae normal; arista with its longest hairs not as long as width of third antennal segment; face almost flat; eyes tapered below, cheek very narrow. Thorax with two pairs of long strong dorsocentral bristles, in front of anterior pair a pair of short setulae, one pair of strong, prescutellar acrostichals, and about 12 series of intradorsocentral hairs; intra-alar short; only one sternopleural present. Fore femur without an anteroventral comb. Inner cross vein close to middle of discal cell.

Length, 4.5 mm.

One female, Cabima, Panama, May 29, 1911 (A. Busck).

Type.—Cat. No. 40957, U.S.N.M.

MINETTIA TUCUMANENSIS, new species

Male.—Shining pale brownish yellow. Frons except the orbits dull; antennae and palpi pale. Thoracic dorsum not vittate; scutellum with a deep black spot at base of each apical bristle. Abdomen with a black central streak on each of the apical three or four tergites. Wings clear, with the following dark brown marks: A broad costal streak from base round apex, extending to middle of submarginal cell, connecting with the dark marks on apices of veins 3 and 4 and fused with the spot over inner cross vein and the two spots on apical section of third vein, a conspicuous cloud over outer cross vein, and a fainter one on base of third vein. Halteres brownish yellow.

Frons a little longer than wide, parallel-sided, orbital and vertical bristles long and strong, ocellar pair very short and fine; face almost flat; arista pubescent; some of the bristles on lower portion of occiput quite well developed. Thorax with three pairs of strong postsutural dorsocentrals, one pair of strong prescutellar acrostichals, the intra-alar not very strong, and about 10 series of intradorsocentral hairs; both sternopleurals strong; prosternum haired. Abdomen ovate. Fore femur without a definite anteroventral comb; mid tibia without posterior setulae. Inner cross vein a little beyond middle of discal cell.

Length, 5 mm.

One male, collected at light between Tucuman and Jujuy, Argentina, on May 4, 1927, by Max Kislink, jr.

Type.—Male; Cat. No. 40956, U.S.M.C.

MINETTIA QUADRATA, new species

Female.—Shining testaceous yellow. Ocellar spot slightly darkened; antennae and palpi yellow. Thorax not vittate. Abdomen

with a dark central streak in middle of apical three tergites. Wings clear, with seven large dark brown marks as follows: An angulated streak from stigma extending over inner cross vein, a subquadrate spot on middle of fifth vein, a subquadrate mark on costa between apices of first and second veins, which is carried over third vein at less than one-half its width on costa, a similarly shaped spot at apex of second vein, a spot on apex of third vein which connects along costa with one on apex of fourth, and a large spot enclosing outer cross vein. Legs and halteres yellow.

Frons subquadrate, all bristles except the ocellar pair long and strong; arista rather distinctly pubescent; eyes rather abruptly narrowed below; cheeks narrow. Thorax with three pairs of strong dorsocentral bristles, the anterior pair close to suture, a pair of long prescutellar acrostichals, six series of intradorsocentral hairs, and the intra-alar bristles very short; sternopleura with one bristle. Fore femur without an anteroventral comb, inner cross vein about two-fifths from middle of discal cell.

Length, 3.5 mm.

One female, Cayuga, Guatemala, April, 1915 (W. Schaus).

Type.—Cat. No. 40958, U.S.M.C.

The black costal setulae extend rather near to apex of third vein but do not attain it.

MINETTIA BRUNNEICOSTA, new species

Male and female.—Shining brown; the head more clay yellow, with frontal orbits and face gray dusted; thorax gray dusted, when seen from behind with four darker vittae anteriorly, the outer vittae on lines of dorsocentrals, the regions laterad of these darker; abdomen almost without dusting. Legs brownish testaceous. Wings dark brown on costal half, the dark color fading out posteriorly, and disappearing behind fourth vein. Halteres brownish yellow.

Frons nearly twice as long as wide, parallel-sided, all bristles except the ocellar pair long and strong; arista long and slender, finely pubescent; eyes narrowed below; cheek about as high as width of third antennal segment. Thorax with three pairs of postsutural dorsocentral bristles, one pair of presutural acrostichals, eight series of intradorsocentral hairs, and the intra-alar quite strong; both sternopleurals present. Fore femur without an anteroventral comb. Inner cross vein beyond middle of discal cell.

Length, 3.5–4 mm.

Female and allotype, Cano Saddle, Gatun Lake, Panama, May 13, 1923 (R. C. Shannon); paratype male, Cacao Trece Aguas, Alta vera Paz, Guatemala, April 21 (Barber and Schwarz).

Type.—Cat. No. 40959, U.S.N.M.

MINETTIA VERTICALIS, new species

Female.—General color and habitus similar to the last preceding species, but the femora and tibiae are darker than the tarsi, the frons is only about 1.5 as long as wide, the antennae are comparatively smaller, the face more noticeably convex below, and the arista is bare. A striking feature of the species is the large number of rather strong, moderately long, bristles across the vertex. The outer cross vein of wing is slightly oblique.

Length, 5 mm.

One female, Cayenne, French Guiana (W. Schaus).

Type.—Cat. No. 40960, U.S.N.M.

SAPROMYZA SCHWARZI, new species

Female.—Testaceous yellow, shining. Frons with a broad brown central vitta which is fully one-third of the width of frons and is bifid in front; antennae brownish fuscous, third segment yellow at base; face with a brown spot in centre of lower margin; palpi fuscous. Thoracic dorsum with four conspicuous dark brown vittae, the submedian pair the narrower and continued to beyond middle of scutellum; an oblique vitta of same color on mesopleura and a large spot on upper part of sternopleura. Abdomen in both specimens before me shriveled so that it is impossible to give details of markings, but there are evidences of dark-brown markings on the tergites. Wings clear. Legs testaceous, fuscous on apices of fore and hind femora, most of mid femora, all of fore tibiae and tarsi, and apices of mid and hind tibiae. Halteres yellow.

Frons subquadrate, of almost uniform texture, shining, and without fine hairs, anterior orbital farther from eye than posterior and much shorter than it, ocellars rather short, about equal to postverticals; arista with its longest hairs fully as long as width of third antennal segment. Thorax with two pairs of postsutural dorso-centrals, a pair of prescutellar acrostichals in line with posterior dorsocentrals, four series of intradorsocentral hairs, situated on the sides of the two submedian dark vittae, and only one sternopleural; scutellum convex. Legs normal, no anteroventral comb on fore femur. Inner cross vein a little beyond middle of discal cell, apical section of fourth vein about three times as long as preapical.

Length, 3 mm.

Two females, Cacao, Trece Aguas, Alta Vera Paz, Guatemala (Barber and Schwarz); paratype, Higuito, San Mateo, Costa Rica (P. Schild).

Type.—Cat. No. 40961, U.S.N.M.

This species is dedicated to Dr. E. A. Schwarz.

Genus GRIPHONEURA Schiner

Griphoneura SCHINER, Novara Exped., 1868, p. 281.—MALLOCH, Proc. Biol. Soc. Wash., vol. 38, p. 75, 1925.

My paper on this genus, which appeared in May, 1925, antedates the part of Doctor Hendel's paper in which he deals with it.

GRIPHONEURA SUFFUSA Malloch

There appears to be no doubt that *proxima* Hendel is the same as this species.

GRIPHONEURA TRIANGULATA Hendel

This species is distinct from any known to me in having the apex of wing clouded and the cross veins with isolated clouds, the palpi black, and several other characters not found in the other species. I have not seen it.

Described from Peru.

GRIPHONEURA FERRUGINEA Schiner

Griphoneura ferruginea SCHINER, Novara Exped., 1868, p. 281.

When I wrote my revision of the genus I had not seen this species, which is the genotype. It is strikingly different from the other species in color, being brownish or yellowish testaceous, with the thoracic dorsum darkest, especially laterally at the suture, and the wings are yellowish hyaline, without dark apices.

The fore tarsus in the male has the same flattened area on base of first segment as have the other species, and here it is over half the length of the segment. There are two conspicuous bristly hairs at apex of fore tibia above which extend to middle of first tarsal segment. The first posterior cell is practically closed at the apex and the bend of fourth ven is evenly rounded.

Length, 4 mm.

Locality, Higuito, San Mateo, Costa Rica (P. Schild). Two specimens in the United States National Museum.

I have compared the above two specimens with the type specimen of *ferruginea* Schiner, sent me for examination by Doctor Zerny of the Austrian National Museum, and find they agree in all particulars with it.



A NEW PTEROSAURIAN REPTILE FROM THE MARINE CRETACEOUS OF OREGON

By CHARLES W. GILMORE

Curator of Vertebrate Paleontology, United States National Museum

Through the kindness of Prof. E. L. Packard, of the University of Oregon, I have recently received for study a fossil specimen found by him in the marine Cretaceous rocks of eastern Oregon. This specimen clearly belongs to the Pterosauria, and, as this reptilian group has not previously been known to occur in the Pacific coast region of North America, the discovery is of much scientific interest.

In North America pterosaurian remains have been found in the marine Niobrara Chalk of western Kansas and in the fresh-water Morrison deposits of Wyoming. Three genera are recognized—*Pteranodon* and *Nyctodactylus* from the Niobrara, and *Dermodactylus* from the Morrison formation. The first two mentioned genera are adequately defined from well-preserved specimens; but the latter, founded on a single incomplete and poorly preserved skeleton, is at this time inadequately characterized.

Well-preserved pterosaurian specimens are among the rarest of American reptilian fossils, and when this pterosaurian fauna is contrasted with those of Great Britain and Europe, with their great number of genera and species of wide geological range, the paucity of our rocks in pteryodactyle remains becomes strikingly apparent. This comparison serves also to accentuate the importance of this latest discovery, in greatly extending their known geographical range as well as furnishing a representative of the order that is intermediate in geological position between the earliest and latest known American members.

In regard to the geological occurrence of this specimen, Professor Packard, under date of September 19, 1927, writes me as follows: "These specimens were found in Cretaceous shales associated with a determinable ammonite fauna of Lower Chico, or possibly Upper Horsetown age." The specimens referred to in the above citation are the pterosaur and an ichthyosaur,¹ the first and only vertebrate remains so far found in this formation.

¹ Merriam, J. C., and Gilmore, C. W., Carnegie Instit. of Washington. Pub. No. 393, 1928, pp. 1-4.

The unique geographical occurrence of this Oregon fossil in conjunction with its intermediate geological position appears to justify its description as a new species, and the specific name *oregonensis* is proposed for its reception. As a matter of expediency awaiting the discovery of more diagnostic materials, this species is tentatively assigned to the genus *Pteranodon*. That it may pertain to a new genus is a fact fully recognized but one that can only be determined by the discovery of more complete specimens.

PTERANODON (?) OREGONENSIS, new species

Type.—Consists of a nearly complete left humerus, two coossified dorsal vertebrae and the articular end of an undetermined bone. Collected by E. L. Packard, 1927.

Type locality.—"Mitchell Quadrangle, Wheeler County, Oreg., S. E. $\frac{1}{4}$ sec. 36, T. 26 S., R. 21 E. About 200 feet above gorge of a small east gulley leading into Nelson Creek about $\frac{1}{4}$ mile above its mouth, not more than 200 feet from southward bend in Nelson Creek Road after it reaches the flat."

Geological occurrence.—Upper Chico, or Lower Horsetown, Cretaceous.

Description.—The few bones preserved of this specimen are remarkable on account of their uncrushed preservation, an unusual condition in flying reptiles. On account of the fragile hollow structure of the bones of the pterosaurs, and especially those from the Niobrara Chalk, they are usually much flattened, with their natural configuration so altered as to leave one in doubt as to their original form. Fortunately, these bones have not suffered in this respect, although important parts of certain of the processes have been lost either through erosional agencies before the specimen was discovered or have been destroyed by subsequent attempts at preparation.

When the humerus came into my hands it was in two pieces, and although the two broken surfaces appear to show contact at the middle of the shaft and the external contours seem to be in accord on all sides, a slight doubt exists as to their being properly united. Professor Packard, however, assures me that there can be no doubt of their belonging together.

A critical comparison of the humerus with the humeri of other American pterosaurs is rendered quite unsatisfactory due to the crushed and flattened condition of all of the Niobrara fossils. Eaton² has called attention to this flattening as follows:

The vagaries of form assumed by the humerus [in *Pteranodon*] under pressure in the matrix are very surprising, the first result of this perplexing situation being that almost every humerus in the collection seems to represent a

² Eaton, G. F., *Memoirs Conn. Acad. Arts and Sci.*, vol. 2, 1910, pp. 28-29.

distinct species. From an examination of 14 practically complete humeri of *Pteranodon* variously distorted, it appears that pressure in the vertical direction (the vertebral axis of the pteryodactyl being supposed to lie in the horizontal plane, with the wings outstretched latterly) usually crushes and shortens the radial crest, while pressure in the horizontal plane not only leaves the radial crest extended to its full length but also alters the head of the humerus in such a way that the radial crest appears to originate farther from the proximal condyle.

It is therefore quite obvious that comparisons made with this material can not be relied upon. Fortunately, a few fragmentary humeri from the Cretaceous deposits of England have retained their natural configurations, and they offer a better basis of comparison with the Oregon humerus.

The humerus is gently sigmoid from end to end. The ends are widely expanded, the distal exceeding the proximal in its transverse diameter, and planes projected through the longer axes of these ends would bisect one another at nearly right angles. The head is elongate, roughly crescent shaped in outline, with the longer axis transverse. The articular face is convex anteroposteriorly and slightly concave or saddle-shaped transversely. Much of the deltoid crest is missing in this specimen, but its great development is clearly apparent.

This process springs from the outer border at some distance below the head, as clearly shown in Figure 1. Its broken base has a greatest longitudinal diameter of 35 millimeters. The ulnar crest is strongly developed, and it springs from the inner border, nearer but also below the level of the proximal end. Comparison with flattened *Pteranodon* humeri seems to indicate a more robust development of this process in the Oregon specimen, and its extension downward on the side of the shaft appears to be greater. These differences, however, may be more apparent than real, for there is so much variation in the Niobrara humeri that little reliance can be placed in observed characters. Between the deltoid and ulnar crests the ventral surface of the humerus is strongly concave but becomes convex immediately below the lower border of the deltoid crest. The shaft decreases in size until in the middle it has a least diameter of 17.5 millimeters; distally it gradually but rapidly expands to the distal extremity. The distal end has suffered the loss of its outer articular surface, and abrasion of the inner surfaces renders their exact interpretation uncertain. There is a large depression in the center of this end, but it is not at all comparable to the deep circular foramen found in the humerus of *Ornithodesmus*, as described by Hooley.³

³ Quart. Jour. Geol. Soc. London, vol. 69, 1913, p. 386, pl. 39, fig. 3.

Measurements of humerus

	Millimeters
Greatest length.....	183.0
Greatest width of proximal end.....	42.0
Greatest width of distal end.....	57.5
Least diameter of shaft.....	17.5
Anteroposterior diameter of head.....	20.5
Anteroposterior diameter of distal end.....	28.0

Vertebrae.—The vertebral column is represented by two vertebrae that are fully coossified. These are uncrushed, and except for the loss of the tops of the neural spines and ends of the transverse

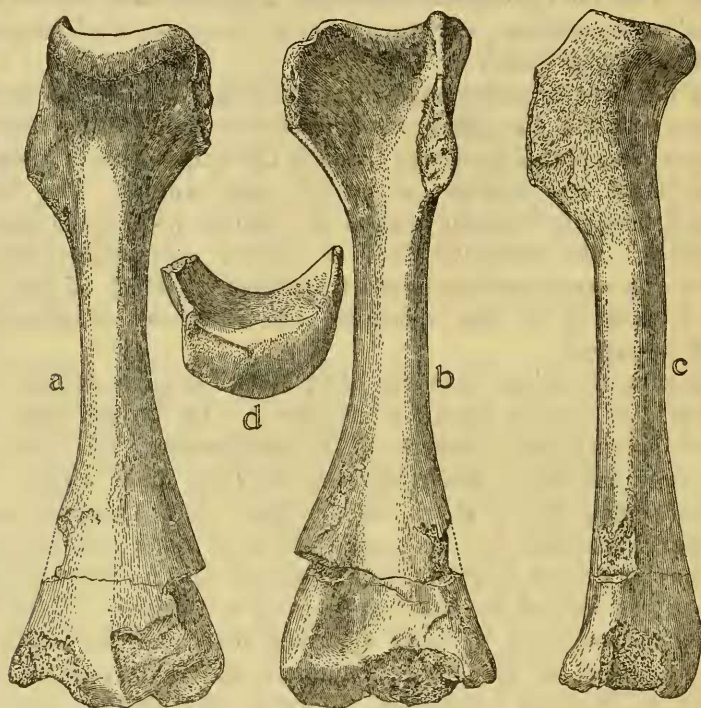


FIG. 1.—LEFT HUMERUS OF *PTERANODON* (?) *OREGONENSIS*. TYPE.
a, POSTERIOR VIEW; b, ANTERIOR VIEW; c, EXTERNAL VIEW; d, PROXIMAL VIEW. ALL FIGURES ONE-HALF NATURAL SIZE

processes are in an excellent state of preservation. Comparisons made with the vertebral column of *Pteranodon* seems to indicate their position to be in the posterior dorsal region. The position of the transverse processes, which have their origin above the level of the neural canal, centra constricted at the middle with expanded ends, and steep inclination of the zygapophysial facets are all features indicative of their posterior thoracic position as shown in Figure 2. In *Pteranodon* the dorsal series consists of eight anterior coossified vertebrae, which is designated the notarium, and they are followed by either three or four free vertebrae which fill the interval between the notarium and the coossified series forming the sacrum.

From a review of all available evidence it is my conclusion that the two vertebrae now before me belong to this free series. The fact of their being coossified does not necessarily argue against this conclusion, for in living birds aged individuals often show ossification of ligaments as well as the coossification of the spinous, transverse, and zygapophysial processes of the vertebrae, and it does not seem unreasonable to believe that a somewhat similar condition might take place in the backbone of these extinct flying reptiles.

When compared with the free vertebrae of *Pteranodon* the greatest dissimilarity noted is in the more prominent development of the ball

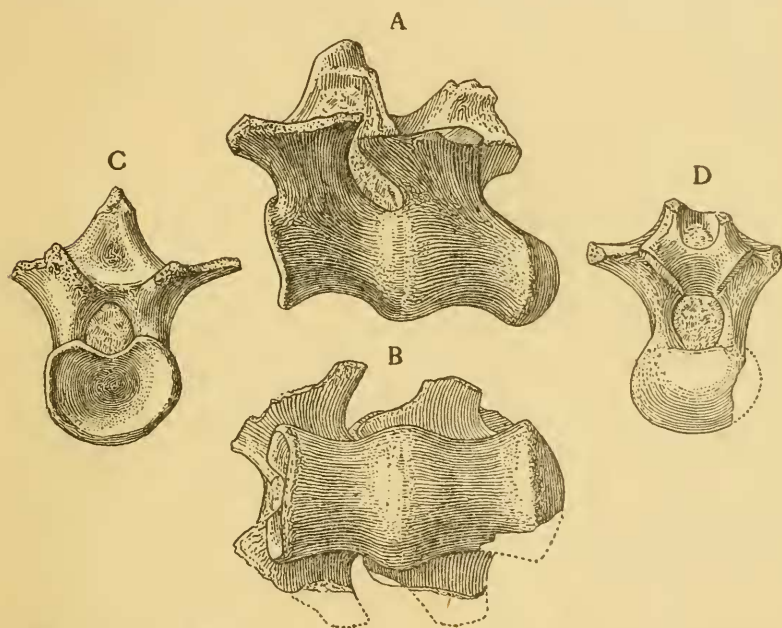


FIG. 2.—DORSAL VERTEBRAE OF *PTERANODON* (?) *OREGONENSIS*. TYPE. *a*, LATERAL VIEW FROM THE LEFT SIDE; *b*, VENTRAL VIEW; *c*, ANTERIOR VIEW; *d*, POSTERIOR VIEW. ALL FIGURES NATURAL SIZE

in the Oregon specimen, which gives the centrum a correspondingly increased length. The pedicels of the arches are also relatively wider anteroposteriorly. The transversely oval shape of the cup, the large size of the neural canal, the steep inclination of the zygapophysial facets are all features in close accord with the dorsals of *Pteranodon*.

Measurements of coossified vertebrae

	Millimeters
Greatest length of coossified centra.....	40
Greatest transverse diameter of anterior centrum.....	18.5
Greatest vertical diameter of anterior centrum.....	15.0
Greatest vertical diameter of posterior centrum.....	14.0
Width across anterior zygapophyses.....	18.5





SMITHSONIAN INSTITUTION LIBRARIES



3 9088 01420 9548